Southern Railways Magazine


315
SOUTHERN RAILWAYS
Magazine
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Indian Railways
Crest Competition

The Railway Board invite designs for a crest for Indian Railways. This crest should be indicative of Indian Railways, and the national emblem should find a place in the design as the Railways are owned by the Government of India.

The crest is intended for adoption on all Indian Railways and should be suitable for use on rolling stock, official publications, letter heads, etc.

Entries should be sent to the Secretary, Railway Board, New Delhi, by registered post, so as to reach him not later than 15th April, 1951. The envelopes should be superscribed "Design for a crest for Indian Railways." These will be judged by a committee of experts and the decision of the Railway Board will be final.

The design selected will be awarded a first prize of Rs. 500/-. A second prize of Rs. 250/- will be given to the next best selected design.

The Railway Board will have full rights to the designs for which the prizes are awarded.

Southern Railways Magazine

VOL. II NO. 10 — APRIL 1951 — ISSUED MONTHLY

Amenities for Passengers

FOR some years past, and more so since India became independent, the travelling public have been hypercritical of the standards and conditions of travel provided for them by Indian Railways. The Ministry of Railways have recently issued an interesting brochure entitled "Towards Better Conditions of Travel," which is a resume of what the Railways in India have done during the year 1950–51 towards meeting the demands of passengers in respect to improved travel conditions. In brief these were :

The introduction of 111 new passenger trains, and the extension of 99 trains on all Railways between 1st April and 31st December 1950, to relieve the overcrowding on trains. Other passenger amenities and facilities at numerous railway stations throughout India were—provision of waiting rooms and waiting halls, refreshment rooms and vendors' stalls, raised or paved platforms, foot overbridges, electrification and improved lighting conditions, improved drinking water supply, bathing facilities, additional booking and reservation offices, electric fans and improved lighting in trains, etc.

In addition to the foregoing, as a result of the recommendations of the Raman Committee which inquired into the hygiene and sanitation of third class waiting halls, latrines, drinking water and catering arrangements on the Railways in South India, the Railway Ministry have issued instructions to all Indian Railways to go ahead vigorously with this programme, which will result in making our Railway Stations better, cleaner and healthier.

During the financial year ended 31st March 1951 Indian Railways spent Rs. 3 crores on works relating to improved passenger amenities, and in spite of the difficult ways and means position, a similar sum has been provided for the year 1951–52. Indian Railways are not resting back on what they have achieved in this respect in the year 1950–51, but are energetically pursuing a similar programme during 1951–52 for the extension and provision of more and more amenities and facilities.

The facts and figures published in the Railway Ministry's brochure indicate what has been done for the better comforts of the millions of people who travel on Indian Railways, but how many of these hypercritical millions are aware of what has been and is being done? It would appear that the average passenger bases his complaints and criticisms against the Railways by his experience while actually travelling in a train. If his journey has been one of

(Continued on page 12)

Notes and Comments

Southern Railways General Manager

BEFORE this issue is out, the inauguration of SOUTHERN RAILWAY would have taken place and fifty-three year old Sri K. R. Ramanujam would have been appointed as General Manager of the integrated Railways. While welcoming his appointment as General Manager, it is essential to present a comprehensive picture of his life to our readers.

After graduation from the Presidency College in the year 1916, Sri Ramanujam joined the Engineering College where he took his Civil Engineering Degree at the age of twentythree. In 1922, he joined the M. & S. M. Railway as Probationer and served in several stations on this Railway as Assistant Engineer and then as District Engineer. He has held administrative posts as Deputy General Manager and Deputy Chief Engineer since 1945. In March 1949 when we had the opportunity to meet him in connexion with the publication of this Magazine, he evinced very keen interest in our venture and assured us all co-operation and support. His very kind assurance gave us an incentive to embark upon this venture and to-day we see ushering in of a new era in the history of South Indian Railways, thus synchronizing with what we visualized two years ago and named our journal as *"Southern Railways Magazine."*

.....Unassuming and Unostentatious Sri K. R. Ramanujam, First General Manager of Southern Railway.

In May 1949, Sri Ramanujam took charge from Sri K. Durai as General Manager of South Indian Railway. As General Manager of South Indian Railway he has achieved many things. The pushing through of the schemes of Adjudication for Traffic Staff and Pay Commission proposals can be cited as examples. From the public point of view also he has done a good lot. Above all, he appears to be a very conscientious Head and has the greatest respect for the average Railwayman who does his duty well.

We hope that our General Manager will do his best for the business community in their multifarious transport problems in his regime as they are the biggest customers of Railways.

It is needless to say anything about Railway personnel as he knows fully well that contented labour is an asset to the administration.

We extend our best wishes to Sri K. R. Ramanujam.

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Ladies Meet

At a gathering of ladies meeting under the presidency of Mrs. P. I. Mathew at the Shoranur Railway Institute last month, Mrs. W. D. Bywater inaugurated the Ladies' Day. She felt extremely glad at the timely decision of the Institute authorities to extend the facilities enjoyed by members to the benefit of their families as well, by setting apart the Institute premises for a day in the week for the use of ladies only. She expressed that it is only fitting to recognise the place of women and prepare the ground for equal opportunities as men to work for the advancement to our country.

Mrs. Mathew, in her introductory speech called upon every lady to utilise the offer to the benefit of herself and every household for a cheerful approach to our life's struggle. She exhorted that by claiming and obtaining a certain right we must not be contended but shall strive to make use of the privileges to the fullest extent. She, therefore, expected everybody to be at the Institute on all Tuesdays and make prove this novel experiment a worthy success.

Mrs. M. J. Mathews, Mrs. T. George and Mrs. Subhadra A. Nair also spoke and wished for the co-operation of all. Next was music by Miss Thulasi Krishnamoorthy (Harmonium), Miss Baby Narayanaswamy (Violin) and Miss Watts (English) that entertained the audience very much.

Sri A. M. Achuthan Nair, Honorary Secretary of the Institute proposed a vote of thanks and the meeting ended with the singing of Janaganamana. Earlier the Chief Guest was entertained to light refreshments prepared by ladies at their respective homes.

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Station Masters on S. I. Railway

Dr. V. Subramaniam, M. P. submitted a memorandum to Sri N. Gopalaswami Ayyangar urging removal of disparities in conditions of service of Station Masters on the South India and M. and S. M. Railways before they were regrouped into the Southern Zone. Dr. Subramaniam suggested that the percentage of Station Masters in the higher scale on the S. I. Railway might be brought up to the level of the M. & S. M. Railway. He wanted upgrading of posts on the South Indian Railway as shown below. According to him, the financial commitment due to such upgrading with retrospective effect from the beginning of 1947 would be Rs. 2,27,140. He also requested that the scale of pay of Station Master as an *ad hoc* arrangement should be modified to Rs. 80—4—180.

Dr. V. Subramaniam's proposal to upgrade posts in S. I. Railway

	CPC Scale		No. of Posts
1.	Rs. 360-20-500	...	1 no addition in posts.
2.	Rs. 300-20-400	...	7 no addition.
3.	Rs. 260-15-350	...	5 no addition.
4.	Rs. 200-10-300	...	10 no addition.
5.	Rs. 150- 7-225	...	65 (55 additional posts).
6.	Rs. 100- 5-185	...	120 (105 additional posts).
7.	Rs. 80- 4-180 (New proposal)	...	Rest (Cost calculated taking the total number of Station Masters in the lowest scale as 14171 Rs. 14171×16 Rs. 2,26,736 Non recurring. (A)

100-5-185 Scale

To increase the number of posts in the next higher scale, Dr. Subramaniam, has taken the average pay as Rs. 80/- when CPC scale was introduced in 1947. To upgrade the next higher scale 105 posts are created ; Rs. 20 is to be given as extra pay per month.

$105 \times 20 \times 12$ Rs. 25,200 per year

To give retrospective effect from
1—1—1947 to 31—3—51 $\times 4\frac{1}{4}$ Rs. 107,100

For difference in annual increment (B) 6050 .....Rs. 113,150

Scale : $\frac{150-7-225-65}{55 \times 27 \times 12}$ (C) $17820 \times 4\frac{1}{4}$ Rs. 75,735

So total additional financial implication under A, B & C
A 226,736
B 113,150
C 75,735.....Rs. 4,15,621

We hope the Railway Ministry will give due attention to the memorandum submitted by Dr. V. Subramaniam and render justice to this category of Railwaymen on the South Indian Railway. It is highly regrettable that the Railway Ministry did not consider the emoluments of a Station Master commensurate with this onerous responsibilities imposed upon him.

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We have pleasure in publishing below two photographs taken on the occasion of Indian Railways Electrical Engineers and Members of the Railway Board's visit to the Standard Batteries factory at Vakola, Bombay. It may be recalled here that the Electrical

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The oft-repeated threats of strike by various Railway Union Leaders when their demands are not conceded would be suicidal to the interests of Railwaymen.

Engineers of all the Railways in India, and members of the Indian Railway Board who had come to Bombay for a Conference, visited the Standard Batteries Ltd. factory at Vakola, Santa Cruz, Bombay last month. They were shown round the factory by the Chairman and the Technical Director and the different processes and operations in the manufacture of train-lighting and other types of Batteries were explained to them in detail.

This factory has the most modern plant in India for the manufacture of hard rubber containers for train-lighting batteries, and produces practically all the different types of hard rubber containers used by Indian Railways.

A recently completed factory building houses the departments for large scale manufacture of train-lighting and other special purpose batteries, as well as the large laboratory for quality control and testing of the Company's products.

To-day most of the trains on Indian Railways are fitted with Standard Batteries. We hope that this firm will continue to play its part in several nation-building activities of tomorrow.

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The Hon'ble. Sri Gopalaswamy Ayyangar is seen in this picture giving away a trophy to G. Lakshmanan of M. S. M. Railway who was adjudged the best athlete in the 17th Inter-Railways Athletic Meet concluded in New Delhi, last month.

Photograph showing members of the General Council of the All India Railways Ministerial Staff Association who attended the Third Annual Conference of the Association held recently at Ferozepore (E. P. R.) under the presidentship of Sri H. V. Kamath, M. P. (Photo By K. N. Mehrotra)

Inauguration of Southern Railway

BY OUR SPECIAL CORRESPONDENT

THE inauguration ceremony of the integration of the three Railways as Southern Railway in the premises of the M. S. M. Railway General Offices reminded me of the historical Constituent Assembly proceedings held on 14th August 1947 in the Red Fort at New Delhi. The huge three storeyed Golconda Fort in Park Town presented a festive appearance. Being a Tamil New Year Day the people were in a holiday-mood. Situated in the heart of Madras and opposite to the Central Station and facing the lovely sea shore with the gentle sea breeze wafting over your face the M. S. M. Railway General Office is a pride of Engineering Workmanship. Its gothic structures modelled on the world famous Golconda Dome arrested the attention of man and reminded him of the hidden talent the Railwayman and the Railways possessed and which could be harnessed to the use of the nation. Madras the historical city which was responsible to allow lone English Trader who afterwards built an Empire, which in spite of Japanese aggression stood aloft untouched. Madras which stood foremost in returning Congressmen in 1937 elections and paved the way for all India, is also responsible for ushering in another milestone in the history and progress of National Railways by integration of three Railways. Mr. F. C. Badhwar, Chairman of the Railway Board bristling with enthusiasm in an *ex tempore* speech paid a tribute to the South Indian people and said "we specially ask for the friendly co-operation of the progressive people of South India on this occasion." Madras deserves this.

Exactly at quarter past four, the quandragle was filled up with men of all ranks and shades. From H. E. the Governor, Chief Minister, High Court Judges, MPs., MLAs., Railway Officials, Editors of Newspapers, men representing business interests and above all rank and file of Railwaymen presented by their Union Representatives thus representing the cross section of our nation were there. This showed beyond all doubt how our people react and respond to a call for a better purpose. This also shows that Railway Transport which touches the life of the community at innumerable points can also be a unifer of our nation. A greater tribute than the one paid by our beloved Prime Minister Mr. Jawaharlal Nehru in his message on the occasion cannot be paid to Railwaymen :—

(*Continued on page 37*)

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discomfort due to overcrowding, or defects and deficiencies in his compartment, his condemnations are severe. The Railway Ministry have, however, admitted that the most difficult problem of passenger travel, is the one of overcrowding due to the enormous increase in passenger traffic during the last ten years, and this problem has yet to be tackled and overcome. Apparently, this can only be alleviated in slower stages, and not as rapidly as the provision of other passenger amenities at stations. But the facts now published are commendable, and are worthy to be given a much wider publicity so that those who are most hypercritical can see that everything possible is being done, within the resources available, towards providing them with better conditions of travel.

M. S. M. Railway News Letter

BY OUR CORRESPONDENT

MR. K. R. Ramanujam, General Manager, South Indian Railway has taken charge of M. S. M. Railway on 31st March 1951 from Mr. W. G. Reid, General Manager of M. S. M. Railway who has proceeded on leave preparatory to retirement. With the taking over charge of the General Managership of Mysore Railways as from 1st April 1951, the Southern Railways is virtually formed with Mr. K. R. Ramanujam taking charge as General Manager, M. S. M. and Mysore Railways. According to notification he is to be the General Manager of the Southern Railways from 14th April, 1951. The press note said that on matters pertaining to the Railway during the period April 1 to14, letters should be addressed to the General Manager of Heads of Department of the South Indian Railway, Trichinopoly, Madras and Southern Maharatta Railway, Madras or Mysore Railway, Mysore as hitherto according as the subject pertains to the areas now under south Indian, Madras and Southern Maharatta and Mysore Railways. Provisional instructions have not yet been issued but will follow soon. H. E. Maharaja of Bavanagar will preside over the function of inauguration of the Southern Railways on April 14. Mr. N. Gopalaswamy Ayyangar will be present at the ceremony. So, a new epoch in the Railway Administration will start in fact from April 14, synchronising with the Tamil New Year.

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The increase in fares which have already taken effect has been justified by Mr. N. Gopalaswamy Ayyangar and expression given to his views at a luncheon party got up in his honour at Visakapatnam on 26th March 1951. His view was that it was necessary to put the Railways on a sound footing. He said that "Our Railways had to be brought to a level which will compare favourably with the Railways of other countries." He added the results that would be achieved in the next four to five years would bear out that he was not unwise in asking Parliament to accord sanction to his proposal to increase the Railway fares. The occasion was made use of by local people to present addresses; there were addresses by the Town Congress Committee, the Anakapalle Congress Committee, the Merchants' Association, Anakapalle, and the All India Railway Ministerial Staff Association, Waltair Branch. Mr. Ayyangar replying to these addresses said that he would take it that the scheme of reorganisation of Railways was received with satisfaction by all in Vishakapatnam, it being the head of the Terminus of the B. N. and M. S. M. Railways. Vishakapatnam will henceforward be the terminus of the Southern Railways.

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Mr. Ayyangar referring to the need for more amenities to Railway passengers said that the Government had set apart Rs. 3 Crores every year to implement their scheme to provide more amenities. He gave expression to his desire that priority for the recommendations of the local Railway Advisory Committees with regard to the implementation of these plans will be given. He also said the amount set apart may possibly be increased in the future. Regarding overbridge at the Waltair Aerodrome level crossing, Mr. Ayyangar promised to get the matter investigated.

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On the question of rolling stock orders being placed on the local Scindia's ship yard, it would appear that Scindia people had not made any request. However, the Government was concentrating on the utilisation of all available talent and skill to effectuate a speedier building of coaches. The Government have invested Rs. 2 Crores in shares in another factory under the Tatas for the construction of Railway rolling stock. Manufacturing of all steel coaches of modern types was also under consideration of the Government. The Government had also decided to import coaches from abroad to relieve congestion. The Railway siding running along to the shipyard was thrown open by the Minister.

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Mr. W. D. Lorimmer, President of the Locomotive Manufacturers' Association, Great Britain who had been in India for five weeks said at Bombay that he was favourably impressed with the working of our Railways as a very good complement to the Government indeed. He appears to have visited the Chittaranjan Works and to have discussed with Mr. N. Gopalaswamy Ayyangar and other officials the problems of the Railway system in India. According to him, the Chittaranjan project which has already become one of the most modern and best equipped locomotive works in the World has made astonishing strides in the last fourteen months. The big factory is a wonderful achievement on the part of the Engineers concerned. The management, according to him, has shown a fine spirit and as long as this spirit continued success was assured. He considered, in the near future, India will be self-sufficient in Locomotives and in the more distant future it is not difficult to foresee locomotives being exported to Foreign Railways. He was of the view that the agreement between India and U. K. for the latter providing technical assistance for this Industry will be satisfactorily working as long as there was friendly co-operation and difficulties should there be any could be overcome by both parties working together.

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In spite of popular protest, the Janata Express has vanished as a nine days wonder. The authorities had worked out, as it were, enough justifying evidence for the action. A careful analysis of their claim that the train did not attract the people, discloses too vividly, the Railway Authoritis are more to blame in the matter than the people. Sufficient publicity in the rural parts has been wanting. The mail fares acted, as a deterrent, and the running of train closely after a passenger in the same direction cannot be expected to induce a change in the psychology of the rural people one of the wanting for the next faster and costlier train instead of crowding in the earlier passenger and a train to which they have been always used to. Whatever the reasons, the authorities cancelling the Janata Express from Madras is erroneous and not, at any rate, in the interests of the common man.

There is not a fiercer hell than failure in a great object.—JOHN KEATS.

Nizam State Railway News Letter

BY OUR CORRESPONDENT

OVER the N. S. Railway, preparations are afoot to separate the Road Transport Department from the N. S. Railway. The separation which was to come off last year was somehow stayed off for the whole year and is now almost imminent. The N. S. R. employees are agitating much against this move. In an editorial entitled "The Crucial Month" the N. S. Railway Employees' Organ "Railway Worker" commenting on this mover says:—

"During the month nearer home, feverish preparations are afoot to separate the Road Transport Department from the parent Railway. The separation which was stayed off for the whole of last year is again contemplated and worked out. This time the dice are heavily loaded against the workers and unless the combined force of the rail and the roadmen is brought to bear on the Governments Provincial and Central, the separation will have been done are long."

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From April 1, 1951 the South Indian and Central zones are expected to be formed distributing the whole categories of Railwaymen on the NSR. The All India Railwaymen's Federation had demanded and since agreed to by the Railway Minister that the Federation must be informed in detail and be consulted in the whole process of the formation of zonal divisions. Before an exhaustive discussion, on the purport and implications of zonal division, the intention of the Government of India to rush through the formation of central zone is most dangerous to the very existence of the workshop and other categories of the Railway Staff.

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The Government of India is shortly introducing the system of payment of wages to the NSR employees in India Government currency instead of in Halli Sicca currency as at present done. The Employees' Union is agitating against this move too on the ground that this mode of payment would operate as a 16% cut in the wages of the workers. At present the exchange rate of 100 India Government rupees is equal to 116-10-8 Halli Sicca rupees. When H. S. currency is withdrawn from circulation, which is going to be shortly, the legal tender will be the I. G. currency in the whole of Hyderabad State. At present all prices are quoted in H. S. currency. When the changeover takes place, it will affect adversely all categories of workers.

For instance if the house rent is at present paid in H. S. currency, the same amount will have to be paid in I. G. currency after the changeover. If a worker pays about Rs. 35/ H. S. now (this is equivalent to Rs. 30/- I. G. Currency) after the changeover too he will have to pay Rs. 35/- I. G. currency. This will mean he will have to pay Rs. 5/- more without corresponding rise in his wages. Because his salary which is at present paid in H. S. currency will be same as he will be paid only the equivalent of that amount in I. G. currency. Thus milk, vegetables and other necessaries of life which are at present sold at H. S. rates will automatically become I. G. currency rates thus giving rise to 16% increase all-round over night.

The Railway workers are not averse to changes but the changes, they say must not adversely affect the employees. All the above contemplated changes have a

direct bearing on the emoluments of the workers but all in the negative direction. Naturally they have to be resisted and fought out to be modified suitably.

The only way to solve this problem will be to give an increase of 16% in the emoluments of workers or else to bring in legislation in Hyderabad State to force payment only in I. G. equivalents of former rates for commodities. This will be difficult in practical application. Neither an increase of 16% would be possible.

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As a protest against the reinstatement of Mr. Thyagarajan, Foreman, RTD Workshops, who was reported to have ben charged with theft of Railway property, the workers of the RTD Workshops staged a tool down strike on Monday 26th March at 14 hours and continued the strike till the next day. After much persuasion by the President of the Union Dr. N. M. Jaisoorya who promised to take up the matter with the General Manager on his return to Secunderabad they resumed work on 27th of March.

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To protest against the proposed separation of the RTD from the Railway, the Staff of the RTD resolved not to overload the buses for a period of one week from the 25th March.

As Railway Staff were not granted holiday on the 29th, the day of the Municipal Elections in Secunderabad and Hyderabad, the workers of Lalaguda resolved at a mass meeting held on the 28th March that they should stay away from work on the 29th so that they may exercise their right to vote. They demanded that 29th must be treated as a day's leave with full pay.

The Railway Administration however permitted employees desirous of exercising their franchise to leave office at 14 hours on the day of the Municipal Elections.

Mr. B. Mallikarjuna Rao General Secretary of the N. S. Railway has contested the Municipal Elections and he is expected to be elected in view of the solid votes of the Railway having been cast in his favour. The results of the elections will be made known shortly.

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The employees of the N. S. Railway working at headquarters are agitating for the opening of V Form in the Railway School at Lalaguda. Last year the Railway Authorities opened IV Form and this year it is learnt the Administration is not apparently willing to open the new High School Class—V Form. Tnis will result in complications to the students now studying in IV Form of the Railway School as they will have to seek admission elsewhere which would mean unnecessary hardships to the employees' children. The fees charged at the Railway School at Lalaguda are nominal whereas outside, they are very high comparatively. This will tell upon the family budget of employees who have boys and girls studying in High School Classes.

The Administration now hold the view that Education is the responsibility of the State Government and they have nothing to do in that direction. When the Union Representatives met the Educational Authorities of the Hyderabad Government and ventilated their grievances, they are reported to have told the Union Representatives that the local government are not able to take over the schools run over by Railway for administrative reasons. But they had promised to pay some subsidy to schools run by the Railway should the Administration find any financial difficulties in running them. But the N. S. R. Administration, it is said, have not moved in the matter any further either to open V Form for the next academic year or to take advantage of the State Government's offer of a subsidy for running the Railway Schools.

There are at present 12 schools mostly primary at different centres in the state run by the N. S. Railway Administration.

Will the General Manager of the NSR kindly look into this ?

(*Continued on next page bottom*)

Our London Letter

BY A CORRESPONDENT

IN the last London letter the resignation of Sir Eustace Missenden from the Chairmanship of the British Railways Executive was reported. At that time his successor had not been appointed. News has now been received that Mr. John Elliot, M. Inst. T. Chief Regional Officer, London Midland Region is to become Sir Eustace's successor. Mr. Elliot was born in 1898 and was educated at Marlborough and the Royal Military College, Sandhurst. He served in the 3rd Hussars in the 1914-1918 war and resigned his commission in 1920, to take up journalism. He joined the Southern Railway in 1925 and was appointed Development Officer in 1930. In 1933 he became Assistant Traffic Manager and Assistant General Manager in 1937. He was Deputy General Manager in 1939 and General Manager in 1947. When the British Railways were nationalised on January 1st 1948, Mr. Elliot was appointed Chief Regional Officer of the Southern Region and later to the same position on the London Midland Region.

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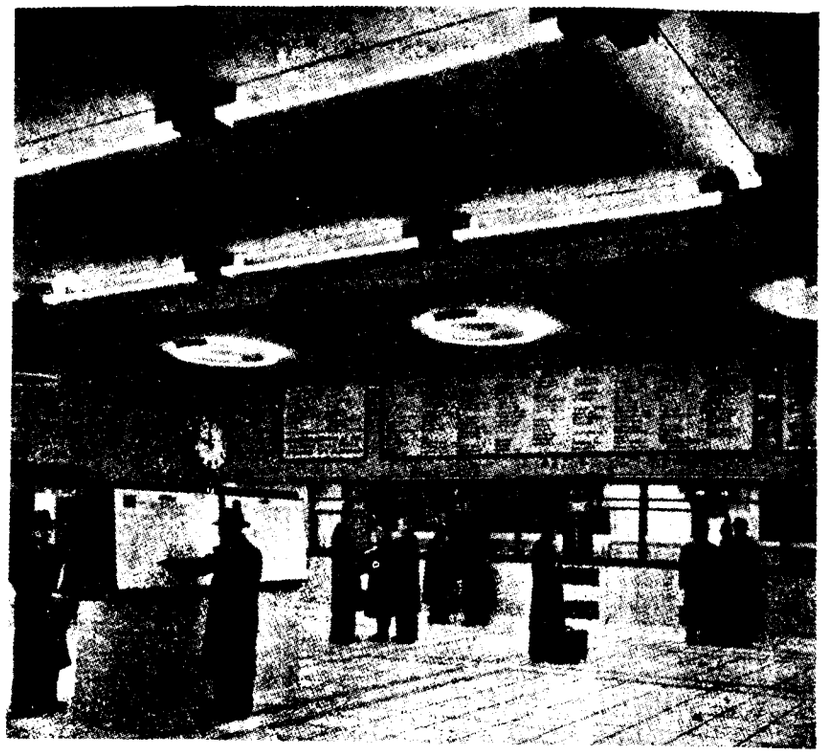
Crewe works have just completed the first of 159 standard locomotives to be built by British Railways in 1951. It is a Class "7" 4-6-2 mixed traffic locomotive No. 70,000 and it has been named *Britannia*. Other British Railways standard types, as well as this one, were designed and built under the direction of Mr. R. A. Riddles, Member for Mechanical and Electrical Engineering, Railway Executive. Derby was the parent office for the design but important sections were also designed at Brighton, Doncaster and Swindon which is part of the Executive's policy for using all the resoures of the regional mechanical drawing offices covering the standard types as a whole. The locomotive has two 20 ins. x 28 ins. cylinders, 6 ft. 2 ins. diameter coupled wheels and a boiler pressure of 250 lbs. per sq. in. The starting tractive effort is 32, 160 lbs. This type of locomotive is intended for main line passenger and fast freight services of the kind now handled by Western Region "Castle," London Midland Region "Royal Scot" (rebuilt), Eastern and North Eastern Region "V 2" Class and Southern Region "West Country" locomotives. There is a definite policy of linking mechanical simplicity with largest possible steam capacity in the combination of two cylinders with a wide firebox. This is unusual in British design and has not been followed since Ivatt's Atlantic of 1903. The first 15 of the 25 engines of this type to be built at Crewe Nos. 70,000 to 70,014 will go to the Eastern Region for service in East Anglia.

The naming ceremony of No. 70,000 was performed by Mr. Alfred Barnes, Minister of Transport at Marylebone Station on January 30.



The new booking hall at Victoria, Eastern Section, Southern Region.

Radio is being increasingly used on Railways all over the world and many of the initial troubles, particularly with regard to geographical difficulties, are being steadily overcome. Until now its application has been mainly restricted to marshalling yards since the use on running lines has been limited by the effect of tunnels. Sometime ago experiments were conducted in Lees Moor tunnel with metre wave equipment which implied that three relay stations would be necessary inside the tunnel for reliable exchange of messages between signal boxes situated half a mile and one and a half miles from its portals. Recently the G. E. C. research laboratories in conjunction with the London Midland Region have conducted experiments on decimetre wavelengths at Primrose Hill and Watford tunnels, near London. Reliable communication was obtained through both tunnels on 460 Mc/s curvature of the line having little effect. No relay stations were employed. Using this frequency there was however, a marked reduction in signal strength when the transmitting aerial was moved just inside the tunnel and the receiver was in the open at the other end. On 1.400 Mc/s this effect was not noticed but the conclusion is that for practical reasons the lower frequency would be preferred. The recommended range in and through tunnels is between 82 Mc/s and 460 Mc/s using relay stations at the lower end.

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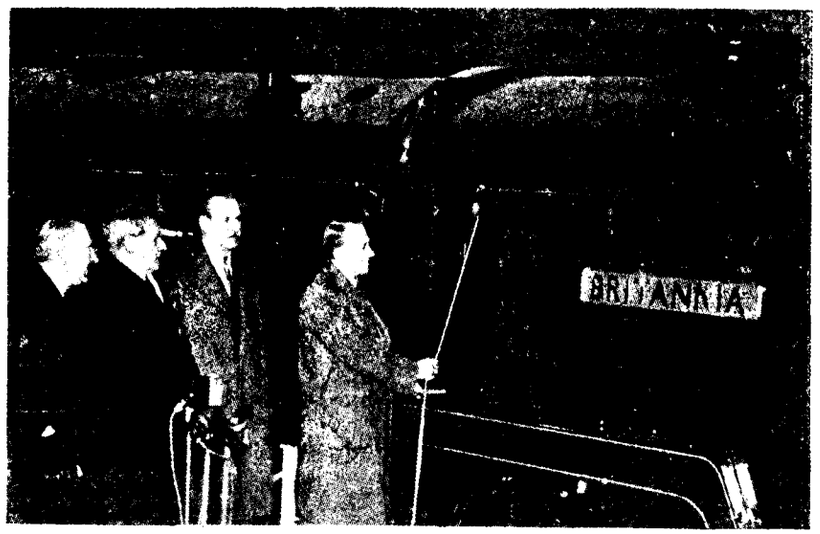
Victoria Station has a new booking hall for the Eastern Section (Southern Region). It is the most up-to-date at any London terminus and although slightly smaller than the one it replaced it



Mr. Alfred Barnes, British Minister of Transport, performing the naming ceremony at Marylebone on January 30 of British Railways Standard Locomotive No. 70,000. With Mr. Barnes are (left to right), Sir Eustace Missenden, then Chairman of the Railway Executive, Lord Hurcomb, Chairman of the British Transport Commission and Mr. R. A. Riddles, Member of the Railway Executive for Mechanical and Electrical Engineering.

appears larger on account of clear floor space. It is flanked on three sides by a modern glass fronted, ticket office, an attractively designed bookstall and a row of telephone booths. The six ticket windows have bronze frames and illuminated, inter-changeable "first" "third" and "advanced booking" notices. The centre of the floor is occupied by the time-tables and a clock. Perhaps the most striking feature is the lighting which is of the cold cathode type arranged to form a circular decorative ceiling fixture. It is also installed in standard fittings forming a rectangle over the centre of the hall. The use of white and gold tubes together gives a pleasant warmth of tone which is a further step forward in treating lighting as an architectural feature.

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Over 10,000 people may be water-borne on the River Thames at peak hours during the Festival of Britain. It is planned to divide the river's water services into four main groups. These will take the form first of an augmented water bus service covering every pier from Putney to Greenwich. The second will be a twin service between Hammersmith and Battersea Park and from Greenwich to the south bank site of the Festival. The third will consist of a shuttle service from South Bank to the Festival gardens and fourth an extension of the pleasure boat services.

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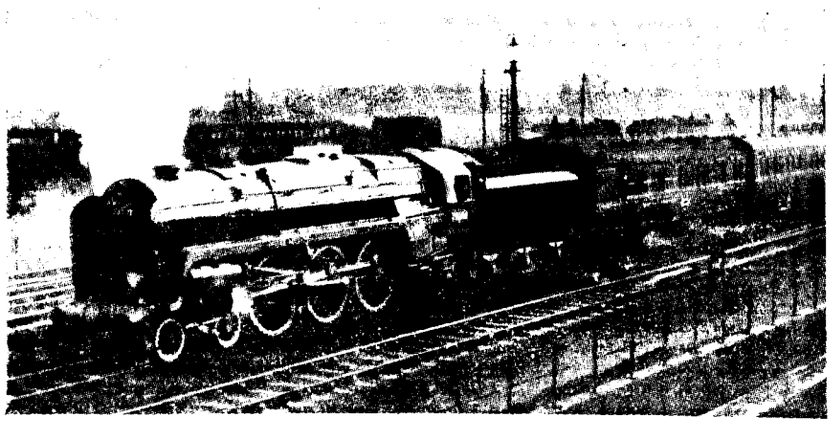
On the open sections of the Railways of the London Transport Executive the installation of conductor rail de-icing machines was completed at the beginning of the year. The work was spread over three years and involved the manufacture and installation of 811 of these machines, 215 on new and extended lines and the remainder on existing lines. It is an invention of a member of



4-6-2 mixed traffic locomotive No. 70,000 "Britannia" on test run with dynamometer car leaving Crewe.

London Transport engineering staff and has been the subject of extensive experiment for a period of over eight years to obtain conclusive results under the severest weather conditions. The device consists of an 18 ins. metal bath inserted in a gap in the conductor rail to which it is connected by means of a steel sole plate the current being carried across the gap through a copper bar on the underside of the machine. A spring mounted rubber roller inside the bath can be raised sufficiently to make contact with the collector shoes of passing trains. With the roller in this position anti-freeze solution from the bath is transferred to the shoe which spread a continuous film of it along the top surface of the rail thus preventing the formation of the ice crust which would otherwise interrupt the transmission of current from the rail to the shoes.

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Snow ploughs have been fitted to 45 locomotives of the London Midland Region. Other snow plough units, the most powerful of which can "bulldoze" a way through snowdrifts up to 12 feet deep, are ready to go into service. They are stabled in the most vulnerable district on the London Midland between Leeds and Carlisle where the line crosses the Pennines, 1,000 feet above sea level.

Fluorescent Lighting on Station Platforms

BY A CORRESPONDENT

MANY Railway Station platforms in Great Britain are still badly lit, even when electric lighting is present. Dark patches still persist and it is often difficult to decipher what is on the station nameboard.

Fluorescent lighting has been installed on the Piccadilly line platforms at Piccadilly Circus station on the London Transport Executive and has been in use for some years. It gives a pleasant, daylight appearance and is shadowless.

In the autumn of 1949, when the electrified Liverpool Street to Shenfield section of the Eastern Region, British Railways, was brought into use, fluorescent lighting fittings displaying the station name were installed for the illumination of the covered part of the station platforms. This type of lighting is now being extended to the open part of the platforms by means of lanterns, each containing two 5 ft. 80 W. fluorescent lamps, designed to the requirements of the Electrical Engineer, Eastern Region, by the General Electric Co. Ltd. The lanterns are being erected at Stratford, Gidea Park, Ilford, Harold Wood, Seven Kings, Brentwood, Goodmayes, Shenfield, and Romford.

Each lantern is mounted on a reinforced concrete column, octagonal in section, with a compartment in the base to accommodate the usual control gear for the lamp circuits. The mounting height to the centre is 12 ft. 6 in. and the columns are 40 ft. apart.

Fluorescent lighting at Stratford Station, British Railways, North Eastern Region.

On the single platforms, the lanterns are mounted parallel with the track, and those on the island platforms are at right angles to it. The light distribution is such that both methods of mounting provide very even illumination, averaging about one lumen per sq. ft. over the whole platform at right angles to the direction of travel of the trains it is easier for passengers to read the station names.

Special attention has been given in the lantern design to any maintenance arrangements and resistance to the effects of weather and soot or grit in the atmosphere. The lamps, arranged one above the other, are totally enclosed by an opalescent trought of low light absorption, with the station name in dark blue on both faces.

The lantern body is made of light alloy, with high corrosion resisting properties and has a hinged top which can be opened for access to the lamps by loosening two captive screws. When the top is open, it is supported by a stop in a position which enables it to be used conveniently as a tray in which a new lamp can be placed while a lamp needing replacement is being disconnected.

A steel tube at the bottom of the lantern carries a central cast-steel mounting cap which is attached to the top of the column by two bolts. This arrangement permits easy removal and gives a rigid support for a lantern large enough to accommodate two 5ft. lamps.

A "National" Colour Scheme for Rolling Stock

BY G. H. GATES-REED, M. I. A. M. A.

ALTHOUGH personally, I have not seen anything in writing, I understand that eventually the main exterior colour for all railway coaches on India's nationalised Railways will be Gulf Red (ISC-473). This is the most widely used colour throughout the world for rolling stock because of its extreme durability; its ability to *'take it"* from the weather. Other hardy colours are Light Purple Brown, the Brunswick Greens, Chocolate, and the Browns, all of which, in various degrees, will stand up to rough climatic conditions, and are better than most other colours; although Gulf Red leads the field.

With particular reference to operating conditions in India, this durability of the paint film must definitely receive top preference when Colour Schemes are being considered. An all-colour show piece train may be good to look at, good publicity, but to standardise to it would be economically unsound. In other countries, particularly the more northern climes, a much wider choice of colours is possible However, the main factor operating against variety is that most railways are state-owned, and so standardise to one colour. In the days before the nationalisation of British Railways, each railway had its own scheme from the Green of the Southern Railway to the Gulf Red of the London Midland & Scottish Railway. The old Caledonian Railway (a Scotch concern) used blue. And there is of course the world famous Blue Train. Yes, it is blue; although the Golden Arrow is not Yellow. Today British Railways are standardising to Green.

Artistically, aesthetically, as you wish, it is a pity that there has to be so much standardisation but of course, it has many advantages. The immediately obvious ones are bulk ordering, ease of stocking requisite paints, and the interchangeability of stocks, etc.

Presumably interior schemes will also be standardised although at the time of writing, I have no information on this.

In 1947, I attended a display at Howrah Station of coaches painted with various colour scheme suggestions put up by the E. I. Railway. From these it was hoped the body of experts, which included paint technicians and experts in Industrial Design would evolve the perfect Schemes exterior and interior. The preference then also was for Gulf Red for exteriors because of its great durability.

The use of aluminium on roofs is a sensible colour to standardise to, and an excellent example of how colour can be used to achieve an objective for there is no doubt that an aluminium coloured roof (exterior) does help very considerably to keep the interior of compartments several degrees cooler. (For that reason it is used on oil storage tanks).

Incidentally, at the time of the exhibition of these coaches, the famous Silver Arrow Train was also on display. It seems a pity that this idea was not taken further. There is a tendency towards excessive dullness these days and without going against the points made above, one feels that a little more originality in the use of colour

might help to re-establish the romantic appeal of railways in the public mind, a point not without its publicising significance. Even if the coach structures themselves are not actually streamlined, a stream-lining effect can be obtained with a planned colour scheme, and even when using Gulf Red. The two-colour scheme of the U. K. Great Western Railway, before nationalisation, was most effective.

Perhaps, however, the last word has not yet been said. In any case one hopes that the new symbol design for India's national railways will be a really colourful one. Regarding this, surely Govt. could have offered more than the Rs. 500/-as a prize? After all, the accepted design will be used throughout the length and breadth of India, presumably for so long as railways last as a means of transport, so that in time, obviously it is going to become a household design; a national emblem as it were. It will be familiar to all of us, literate or otherwise, and in its way a part of our national heritage. Rs. 500 -seems a small prize to pay for such a contribution.

Perhaps a further prize could be offered for a colour scheme, which acknowledged the need for standardisation to durable colours, but which brought a rakishness to existing rolling stock through the manner of its application.

Presenting Mr. Railwayman

"The Traffic Inspector"

BY A. H. PEARSON

IF you want to find out what a Traffic Inspector looks like, don't search for him among the uniformed Railway Staff you often see on station platforms or offices, because he does not have to wear a uniform. If some Railwayman one day told you, "see that fellow there, the man in khaki shorts and open neck shirt, with a bundle of papers tucked under his arm, well that's Ramanathan, our Traffic Inspector," your retort would be, "if you hadn't told me, I wouldn't have known he was a Railwayman." To all Railwaymen the Traffic Inspector is familiarly called the T. I., and we will refer to him as such from now on.

On some railway systems the T. I. does both transportation and commercial supervisory inspections and work, but on others these functions are done separately by a Transportation Inspector, and a Commercial Traffic Inspector. In this article, we will concentrate on the job of work done by the Transportation man.

The T. I.'s length may consist of anything up to about 130 miles of his Railway, and within this length of track his jurisdiction may embrace about 30 stations, both large and small. At least once every two months he must pay a visit to each one of these stations and make a detailed routine inspection; and this is how it is done.

The T. I. has left his home station in the early dawn, boarded a train, which gets him into Ramgaon—the station to be inspected—about 8 a. m. in the morning. Now, Ramgaon may be an engine-watering station, with two cabins, an up and down main running lines, an up and down loop for holding goods and slow passenger trains, and a goods shed with siding. The T. I. will usually start with the cabins first. The Cabin signalman will produce his train signal and cabin log registers for inspection. The T. I. will then make a careful check of a few day's transactions to see that the cabinman has been doing his job thoroughly. If he finds anything wrong, the T. I. will bring this to the notice of the cabinman, and also make a note of it for his inspection report. Next he will watch the cabinman at work for a little while, ask him questions to ensure that he knows the rules and how to work his cabin. All cabinmen must be thoroughly competent in the duties required of them, as the safety of all train passing movements controlled by the cabin, depends on his efficiency.

The T. I. will then pass on to the station itself. Accompanied by the station master, he will make a tour of inspection of the station premises and yard, paying special attention to the cleanliness and sanitation of waiting rooms, waiting halls, station offices and even the small Railway Colony nearby. All points needing attention are brought to the notice of the station master, and if the latter has any difficulties, he must not hesitate to acquaint the T. I. of these, so that the latter may pass on the information to the divisional or district authorities.

When this has been completed the T. I. will spend some time in the Office of the Assistant Station Maters on duty, watching him doing his train passing and other duties. If there is any shunting operation in progress in the yard, the T. I. will be watching this with an alert eye, to see that every move is being done within the least possible time. While observing these movements the T. I. may find that they are

taking too much time, and now he must study the layout of the yard on the spot, to see if any re-arrangement of the sidings, loops, cross-overs, etc. may help to cut out unnecessary shunts. If this can be done, he will make notes with sketch diagrams, and later send in his suggestions to his superintendent at headquarters for examination. During the course of his inspection at this station, and every other station on his section, every aspect of transportation working must be checked, and defects, defaults and deficiencies immediately noted and reported, so that improvements can be effected.

Once in a while the Transportation Superintendent finds that there is a nasty decline in train punctuality in his division or district, which may continue over a certain length of time. This has got to be stopped. So the Superintendent calls a meeting of all his T. Is., apprises them of the situation, and then tells them to get on with the job of ascertaining the cause of the rot, and to suggest quick and effective remedies to get those trains running 'on time.' Now, how does the T. I. tackle this? By merely poring over reports or rows of figures? Not at all. He is not a paper man, but a man of action. The best way to ascertain why a train is losing time, is to travel on that train day after day for a few days, and wherever each minute in time-keeping is lost, he must find out the reason why. The train has an eight-minute scheduled halt at a station, but it pulls out three or four minutes late. Where is the T. I.? Sitting comfortably in his compartment? No, he is there on the platform. Perhaps, due to heavy seasonal traffic more time has to be taken in loading and unloading packages from the brake-vans. Can the process be speeded up? Or, there may be a sort of epidemic of alarm-chain pulling on a certain section. Why? The T. I. must find out. Is loco responsible for the bad running of the train? Well, the T. I. must have a chat with the driver and find out why? After doing several trips with the same train the T. I. will then know why trains are losing time, and also will be able to suggest ways and means to cut out the time losses. His detailed observations and suggestions will then be passed on to headquarters for action. But if he can eliminate time losses on the spot by pointing out to staff where they are slacking, he does not hesitate to do so.

Another part of the T. I.'s job is to conduct what are known as sub-joint enquiries. A minor accident may have occurred in a station yard, or a breach of the block working rules committed by some staff. So the T. I. along with one or two Inspectors of another department, will convene a kind of court of enqury at which all the staff concerned are cross-examined. When this has been completed the Inspectors will then carefully weigh up the evidence collected, draft out their finding, and state specifically which of the railway staff is held responsible. This has to be done very carefully, as on the strength of their verdict a man will have to be punished for his act of omission or commission.

When travelling in trains over his section, the T. I. is not always in a compartment, taking it easy. Sometimes he will be found with the guard in the brake-van of a mail, passenger of goods train, and he won't be chatting amiably with the guard either. He will be checking on the guard's work.

Is this all that a T. I. is required to do? Far from it. A glance at the files and papers carried by him, or in his despatch in the custody of his chaprasi, will give you an idea of the diversity of

(*Continued on next page bottom*)

investigations he must make, and the points on operating matters for which he must send in reports. And once a week or fortnight, along with the other Transportation Inspectors of the division or district, he will visit the Headquarter Office, for consultations with his Officers.

Office hours, ten to seventeen, and a snug little office to work in? Perhaps, for some Railwaymen, but not for the Transportation Inspector. He may have finished a day's work, taking it easy at home, when his telephone rings. "Yes, Murti, T. I. speaking." What ..... accident at mile 247 near Ramgaon ..... 59 Up passenger collided with the rear of Up goods train ..... passengers reported injured ..... O. K. ..... I'll be on that relief train, don't worry ..... "

So, the Transportation Inspector bustles around again, it may be three o'clock on a cold winter's morning, but what of that; it's all in the day's work.....

Switzerland: Nature's Wonderland

FROM A CORRESPONDENT

FOR almost two centuries Switzerland has been visited by travellers from all lands and spheres, by wanderers and mountain climbers, by scientists and pleasure-seekers, working people and convalescents. It was out of the happy recollections of these thousands that Switzerland's reputation as a tourist centre grew. Yet it requires powerful, natural, perpetual forces to enable a country to retain this reputation in our times, when distances are as nothing and journey's end may mean some alluring spot in the farthest corner of the world. Wherein, then, lies the source of this legendary reputation, which to-day seems to be as much alive as ever before?

The inevitable and spontaneous answer is bound to be "The mountains allure us!" So it was in the middle of the 18th century, when the Alpine world still appeared sinister and menacing to the superstitious, and the same natural enthusiasm and satisfaction which Goethe felt when, in Schwyz, he came really close to the mountains for the first time, is still predominant in the hearts of the plain dwellers and townsfolk when they see the rocky fastnesses rise above them in their awe-inspiring magnitude.

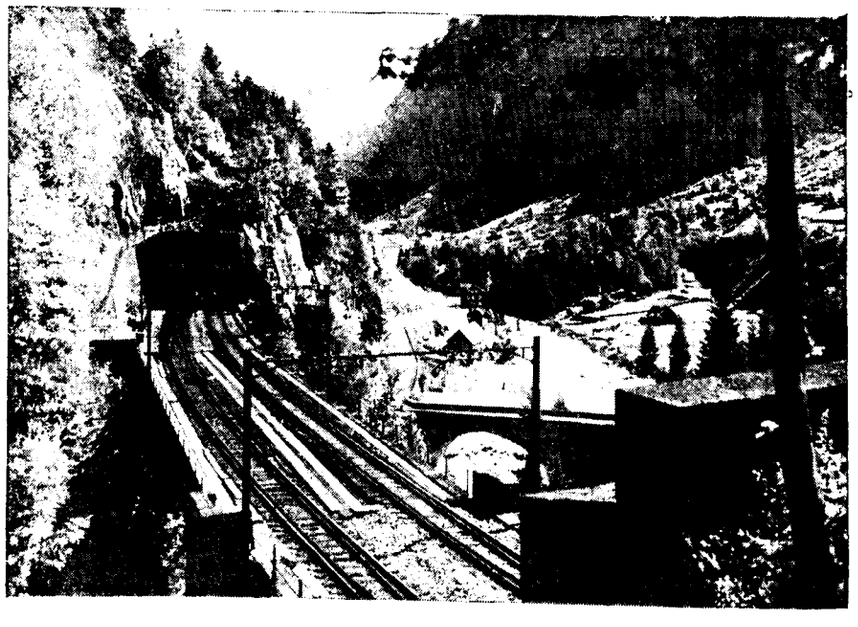
Never shall I forget the bright curiosity of the Hungarian father who, on visiting the lower Engadine with his family for the first time, put his head out of the carriage window and asked excitedly: "Are there any glaciers in St. Moritz?"—Many a traveller who at first believed he would find glaciers spread out before his hotel windows, was in no way disillusioned when he saw how simply and pleasantly the glacier grottos can be reached from the largest resorts.

A visit to Switzerland has enriched and widened the geographical knowledge of innumerable people; they have looked, enjoyed and learned. Other countries also possess mountains and Alpine resorts, but the extraordinary attraction of this country lies in the unique magnitude and multiformity of the mountains. Alpine beauty-spots follow one upon another from Piz Bernina to the Mat-

terhorn and Monte Rosa, from the Jungfrau massif to the Mont Blanc district. Tourists who have travelled considerable distances to see Switzerland find a special charm in being able to visit the most varied kinds of mountain scenery during one stay, and all in the one small country.

They derive from it a wealth of impressions which are a source of happiness to them for many a long year. And they come back again, realising well enough that during one single visit one cannot drink one's fill of the inspiring view of the mountains. Thus the travel pictures are kept alive and glowing from visit to visit, from traveller to traveller, from generation to generation, impressing themselves upon the memory of a whole world of tourists. And from this springs that mysterious attraction which tempts ever new people in the farthest lands to visit Switzerland, the most famous land of travel.

One of the secrets of Swiss scenery is its richness in unexpected contrasts. From the highest passes, where the Alps became a vivid experience, a comfortable journey of a few hours brings one to lake shores possessing all the enchantment of a Riviera A wonderful spectacle on the flower-decked shores of Lugano and Locarno, are the nearby mountains glistening with their new fallen snow. From window, balcony and garden, beautiful contrasts intermingle to form the charm of the complete picture. On the Lake of Geneva a magnificent series of bays opens out between Vevy, Montreux and the Castle of Chillon, radiating the magic of the southern clime and at the time conveying the knowledge of mountains within easy reach. Even, the large Swiss towns are not immune from this element of contrast. Berne lies as a historic settlement of unique architectural beauty in the heart of Switzerland. But one has not merely to suspect and presence of



The St. Gotthard Railway below Wassen, Switzerland.

the mountains here, their panorama unfolds itself triumphantly in the full glory of its lovely charms. In Lucerne, Zurich and Geneva one admires the beauties of a garden city on a lake, and everywhere it is the mountains that give to the picture a brilliant background.

Switzerland's powers of attraction as a land of travel, however, are not only based on the quality of the scenery. It is known and acknowledged throughout the world that Switzerland is the land of pleasant travel and comfortable resorts. The points of interest in the landscape have been developed from the traffic point of view in a manner unequalled in any other country. In fromer years, this development chiefly concerned the Mountain Railways and their ambition to open up more and more sight-seeing points. Then the increasing attention paid to the traveller's comfort led to the establishment of a supprisingly large number of communicating lines between the separate traffic areas, and the arrangement of the communications in as convenient a manner as possible. The express train line, running through the most beautiful mountain districts and connecting the Bernese Oberland with the Lake of Geneva, Davos with St. Moritz, the Engadine with Zermatt, are unparalleled feats of modern Railway technique. In addition, there are innumerable routes over the passes, and made possible by the Swiss Alpine Postal Service.

As regards the care expended in making her resorts pleasant, comfortable and refined places to stay in, Switzerland has always been to the fore. This is not only a question of individual concerns and holiday resorts, but of every place catering for the visitor, hotels of every class—sanatoria pensions, too. Thus the possibility of disagreeable surprises is entirely excluded, whatever eventually the journey may bring. This gives the traveller a feeling of security. It is not only round about the valley stations and touring centres, of which Interlaken was formerly the most outstanding example—that resorts have sprung up during the course of the last century, resorts that are unexcelled the wide world over, but also high up in the beautiful Alpine passes themselves. Davos, Arosa, St. Moritz and Pontresiana, as also Zermatt, offer the travelling public every comfort and convenience that even the city can give. Switzerland is thus a real international land of travel, and everyone knows in advance that he will find there resorts and accommodation, charming educational facilities and all possible amenities for sport. These are the qualifications which Switzerland has developed as an international travel centre during the course of decades. She has built them up by constant labour and care, and now form the foundation of her permanent power of attraction.

Where the Lord Wooed Valli

BY V. SUBRAMANIAN, M. A.

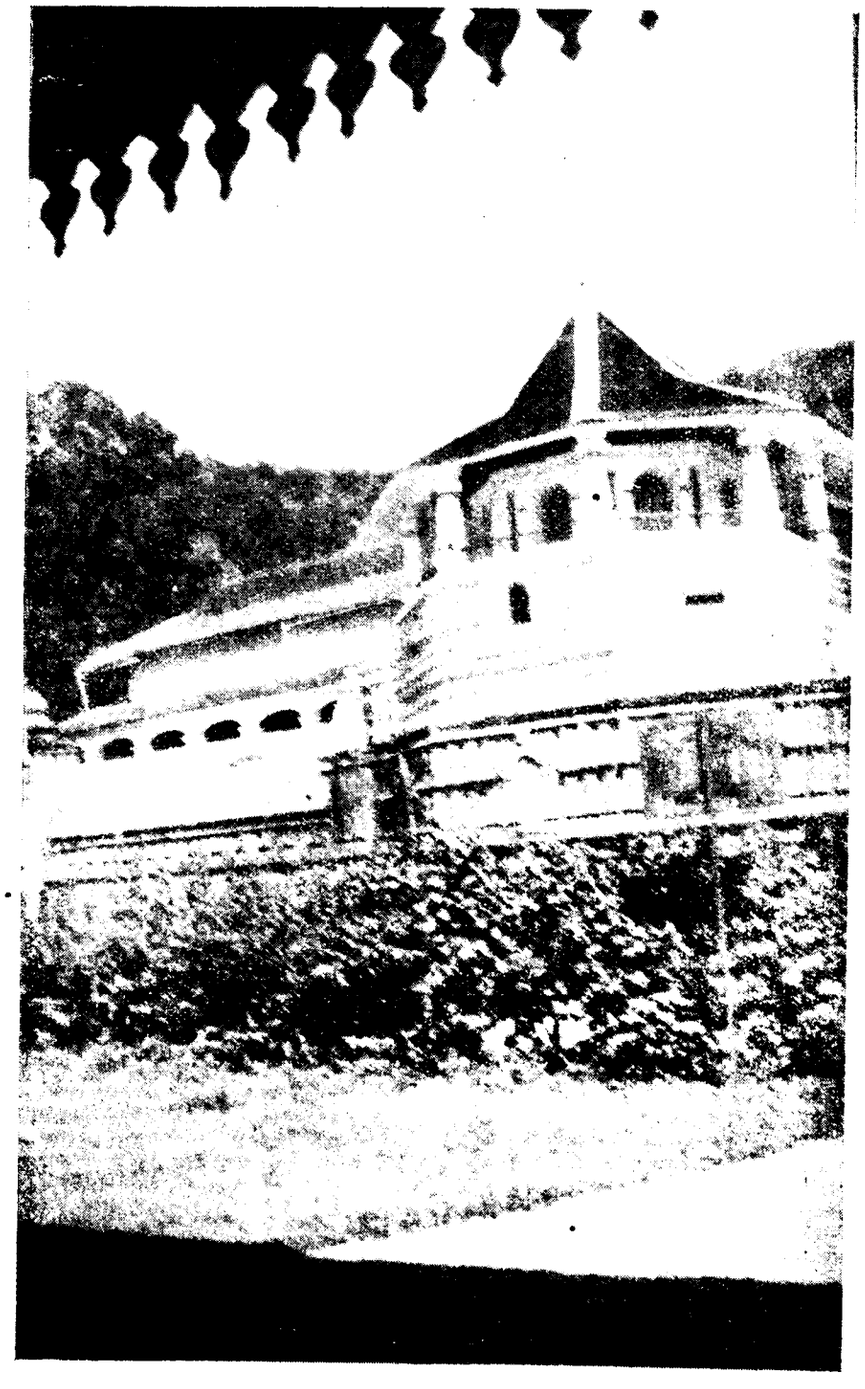
PIOUS Tamils are aware of the existence in Ceylon of a holy place called Katharagama, where the presence of Lord Subramanya or Muruga is still powerfully felt, and where miracles are still the rule. But even in these days of wide travel, the name of Katharagama, is associated more with strange legends than with facts. I made a pilgrimage to the place, just sometime ago, and my recountal of it, may dispel the wrong ideas about the place.

This small village, famed throughout Ceylon and South India, is highly inaccessible even now. The coastal railway of Ceylon, stops at its southernmost terminous Matara, which is about a hundred miles away from Katharagama. I learnt that a place called Tissa Maharama, about ten miles from Katharagama could be reached by bus. The crowded bus, then took me on one early morning to Tissa. From here, one has to reach the holy place of Muruga, by jeep or car, passing through a jungle road, even now quite dangerous.

At Tissa, before I boarded the jeep, I saw the famous dagoba for which the place was noted. It is one of the biggest dagobas in Ceylon, about 150 feet in height. It was originally built in the first century before Christ by the Sinhalese King Kavan Tissa. His grandfather had been defeated by the Pandyan armies, and after losing the major part of his kingdom to the Tamil invader, this king Mahanama held a small area in South Ceylon called Rubunu. His grandson—Kavan Tissa—had built the great dagoba there, and all of them were devoted to the God of Katharagama.

As the jeep speeds by, we pass a great artificial lake known as Tissa Viwa dug up by Tissa, whose wide expanse of waters reflects the steep ascending hills nearby, for in this part of the country, the mountains ascend steeply up from the narrow coast line. Then the jeep goes up through a thick jungle, full of elephants, wild buffaloes and even leopards. It is a dangerous drive though the P.W.D. of Ceylon has laid a well-frequented road, and the recurrent noise of jeeps and carts drive away the wild animals that inhabit that part of the jungle. At last, we come to the bank of the Katharagama river, where the jeep stops. As we cross it, we can see fish leaping up (literally) in high glee for no fishing is allowed here. We come right against the temple at the end of a small street.

The temple is a very unpretentious structure, and kept purposely so, for the temple has enough funds from the offerings of thousands of devotees to put up the most impressive structure It is not, however, the temple's architecture that attracts these thousands from all over Ceylon and South India. It is the air of holiness that pervades it that has made it a pilgrim centre down these twenty centuries. There are two shrines, one for Lord Ganesa, and another for the Lord of Katharagama, i. e. Subramanya. Both are small brick and mortar structures with country tile roofs. The inner sanctum in both is covered by a curtain in both cases, on which a portrait of Ganesa is painted in the first and a portrait of Muruga on the peacock in the second. The devotees are permitted only into the outer hall, while only the pujari goes into the sanctum. There is also a holy pipal tree at the back of the



The Temple of Katharagama

Subramanya shrine and its branches spread over the sanctum.

The method of worship is also very simple and unostentatious. The priest goes inside the inner sanctum and performs worship in both shrines, and comes out with the offerings. But on festival days, the temple is lit with burning camphor, no oil being used and crowds swell the little village, to see the holy box containing the holy yantra mounted on an elephant, going out in procession.

For there is no idol in the inner sanctum, which is dedicated to the nameless, formless and omniscient power which rules the world. Here pure devotion takes the place of display and noise in the wealthier temples.

The origin of this far-famed temple is told briefly thus. After Lord Subramanya slew the demon Surapadma, he fell in love with the Veddah girl Valli by name here and married her in this village. Hence the village is called Kartikeya Grama, which later changed by usage to Katharagama. It seems that Valli requested a saint that her husband should permanently settle down there, and the boon was granted and there imprisoned for ever in the arms of his beloved Veddah wife, the Lord of Hosts (Devasenapati) invisible and elusive, draws thousands of hearts to sing his praises. In commemoration of the Lord's love for his Veddah wife, the Veddah girls of the locality, go out in procession before the elephant, carrying the Lord's yantra. The great Tamil poet Arunagirinatha, has sung in praise of this place, and the tradition is that he came here as a parrot to sing the Lord's praise. In fact, the wild beauty of the place is awe-inspiring and is suggestive of the all-pervasive Power, to which the temple is dedicated.

It has been richly endowed by the Sinhalese kings though they were all Buddhist. Dutugemunu, the younger son of Kavan Tissa (who built Tissamaharama) wanted to gain back the whole of Ceylon from the Tamil usurpers. He even chided his father for his inactivity, and sent him woman's ornaments to dub him as a coward ! He was however advised by people to seek the aid of the Lord of Katharagama till the Lord appeared in a dream and gave him a miraculous sword. Dutugemunu fought with the Tamil king Elara, and in spite of great odds won a victory. In thankfulness, he gave lands and other offerings to the Lord of Katharagama. He is considered as one of the protectors of Ceylon as a result, and the six-headed image of Kartikeya finds a place in many Buddhist temples. Sinhalese Buddhists as well as Tamil Hindus are equally devoted to the Lord of Hosts, imprisoned by love in this village.

Some idea of the awe which the place inspires in religious-minded men can be gathered from the following incident. I started in the morning from Matara and early in the night, I had got ready to board the car back to Matara. A devotee, Tamil Hindu from Jaffna, was with me. He had spent a fortnight there, and was returning rather unwillingly back to Colombo. He saw me with my trousers, and camera and all, and asked where I had come. I told him that I came that morning from Matara to Katharagama and was now going back the same day after seeing the place and taking some photographs. Surprised and pained he said : " You people now talk of coming and going back the same day, and come to the very door of the temple with shoes on. You go round and take photographs unconcerned. Twenty years ago, when we first came here, there was no bus, and not even a road from Tissa. The whole jungle would then be full of frenzied devotees, walking up through the thick jungle, crying Arohara. No wild beasts ever crossed our path then, and miracles used to happen every day. We never remembered ourselves once we entered this holy village. Our hearts were then full of fear and love. The road, the jeep, and electric light have come, and now people like you have come with the camera. The place has lost its holiness in part. The Lord of Hosts does not care to reveal Himself to the indifferent. "

On our way back, our jeep encountered a pack of wild buffaloes which had to be driven away by the noise of the horn. A hooded snake also crossed our path. I wonder whether the ardent devotee of the formless Lord would attribute it to the presence of sinners of my calibre !

(*Continued on next page bottom*)

Anti-Malaria Operations on the Bengal Nagpur Railway

BY M. V. RANGASWAMY

MALARIA takes the heaviest toll of life in India and is India's public enemy number one. The discovery of mode of transmission of malaria is though of very recent date, this spell disease had been known to exist since the time of Herodutus and even beyond. Malaria fever is caused by malaria parasites which are transmitted by female Anopheline mosquitoes from man to man

The Indian Railways sometimes traverse through notoriously malarious tracts, and constructions of these railway lines in thess zones have in the past cost India heavily in men and material. It was during one of such constructions that the malaria organization of the Bengal Nagpur Railway was set up in 1925. Even after the completion of the construction anti-malaria operations have had to be continued in these areas to keep the railway going. It may be mentioned here that it is the only Railway in India which can claim a malaria organisation attached to the Medical Department as old as 25 years.

The main functions of the Malaria Section of the Medical Department are survey, investigation, and malaria control. The control of malaria consists of :—

(*a*) Measures directed against the larvea of Anopheline mosquitoes in water by treating breeding places with anti-malaria chemicals such as Paris Green, Malarial, D. D. T., Gammexane etc.

(*b*) Measures directed against mosquitoes on wings by spray of walls, doors, windows or in other words the sitting surfaces of the mosquitoes with D. D. T. either in solution or emulsion at regular intervals. Prior to the advent of D. D. T. the Railway Quarters and Railway premises in malarious places were sprayed with Pyrethrum Insecticide every day.

(*c*) *Personal protection* :— Running Staff such as Drivers, Guards and Khalasis who have often to stay the night away from their protected Head-Quarters Stations are supplied with mosquito

repellents such as Dimethyl Phthalate (DMP) with necessary advice as to the duration of its effectiveness which lasts not more than three to four hours after application.

(d) Drug Prophylaxis :— The staff living in wayside stations in highly malarious areas and also the running staff who are likely to travel on duty through similar areas are given a tablet of Paludrine (100 mgm. an I. C. I. product) once or twice a week.

In highly malarions areas very large Railway Colonies are protected by anti-larvae measures only, while comparatively smaller ones by both anti-larvae and anti-adult measures and small wayside ones by anti-adult measures and Drug Prophylaxis. Thorough application of D. D. T. or Pyrethrum to all houses in a big colony is neither economical nor practical.

In 1925 there was only one station under Malaria Control and the population protected was 207. By 1950 the number of stations enjoying this benefit has risen to 120 with a population of more than a lakh and a half.

Incidence of malaria at the controlled stations has been brought down to a very low level and this reduction in malaria has resulted in a corresponding decrease in general sickness as well. The introduction of D. D. T. has opened up a new chapter in the control of malaria and helped to bring down the Anopheline population to the lowest level in the D. D. T. applied houses.

The *per capita* cost which was little over Rs 30/-prior to 1930 came down to Rs. 1-3-0 *per capita* before the war time rise in prices due to extension of control over large number of stations. What with the present cost of materials and enhanced rate of post-war scales of pay and allowances the *per capita* cost is now a little over Rs 3/-.

(*Continued from page 12*)

"Whatever achievements or lack of achievements our Government have to its credit or discredit, I think I can say with full assurance that the improvement in the Railway system in India is one of the outstanding achievements of the Government. I can say that without offending my sense of modesty because I have personally had nothing to do with it and I cannot therefore even share the credit. The credit goes to my colleagues, the Minister for Railways and the Minister of State for Transport as well as to the Railway Board and *the army of Railwaymen who work the Railways.*"

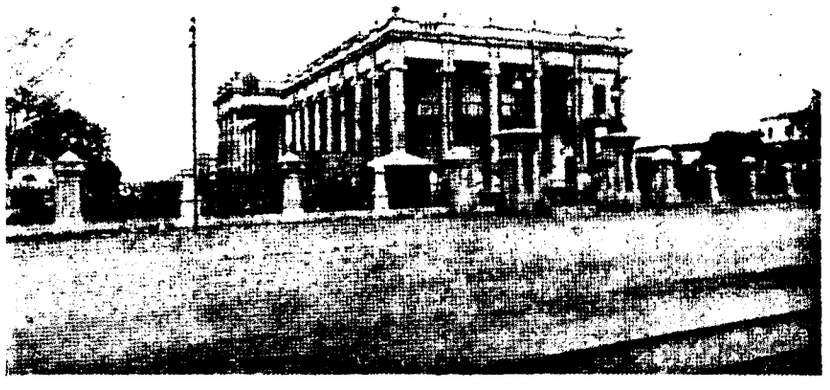
But Railwaymen who love and adore their Prime Minister know that but for him, India would not have been what it is to-day. They are only glad that in spite of his multifarious activities he has kept a warm corner for them and has expressed them in the following words :—

"I send my good wishes on this occasion of the inauguration of the *Southern Railway* and my congratulations to all those from the top to the lower ranks of the Railway Services who serve the public in this greatest state undertaking."

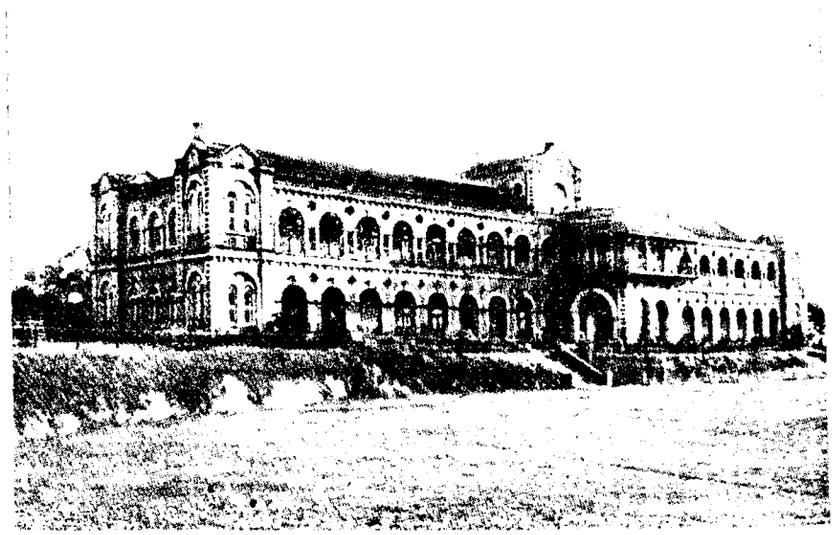
Railwaymen who have been responding to the clarion call of nation ever since Mahatmaji started non-cooperation movement will not fail to rise to the occasion and make the regrouping not only a great success but work it in such a way as to be a model for other regrouping to take place. *All the Railwaymen are lucky indeed to have such an unassuming and unostentatious General Manager of Sri K. R. Ramanujam's calibre whose name will go down in history as the First General Manager of integrated Railway system. We assure the General Manager of our full cooperation and support in working out the Regrouping scheme a great success.*

Back-ground of Regrouping

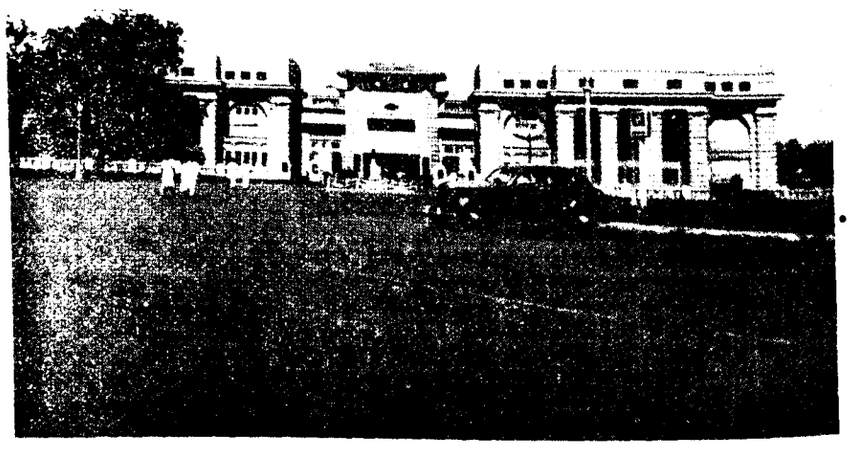
Those of us who know Hon'ble. Minister of Transport Sri Santanam as a Vedaraniyam Salt Satyagrahi in the non-cooperation days launched under the leadership of Rajaji know also his capacity as an organiser and administrator. He is a Congressman head to foot. The Minister said : "In the Dominion of Railway, *the regrouping scheme which has been evolved and of which the first group is to be inaugurated to-day will be remembered as the greatest work*



Headquarters—Madras Railway Company—Royapuram

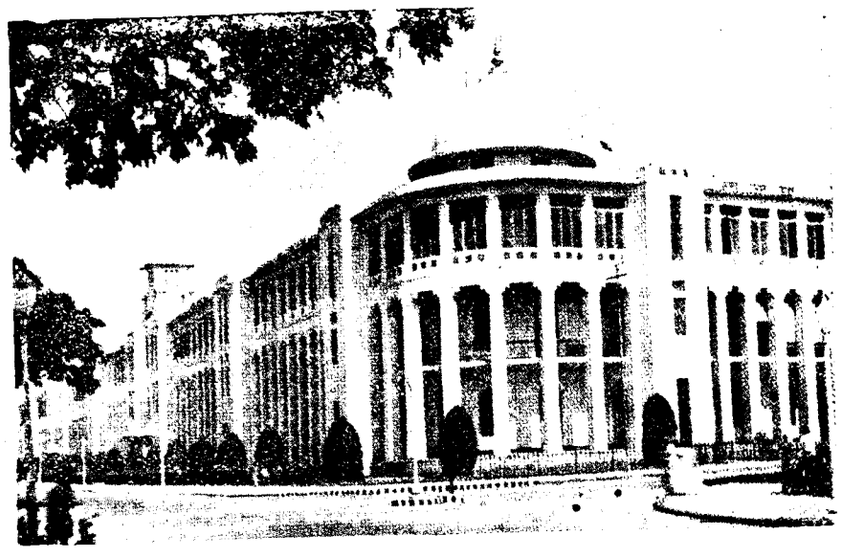


Headquarters—Southern Mahratta Railway Company—Dharwar

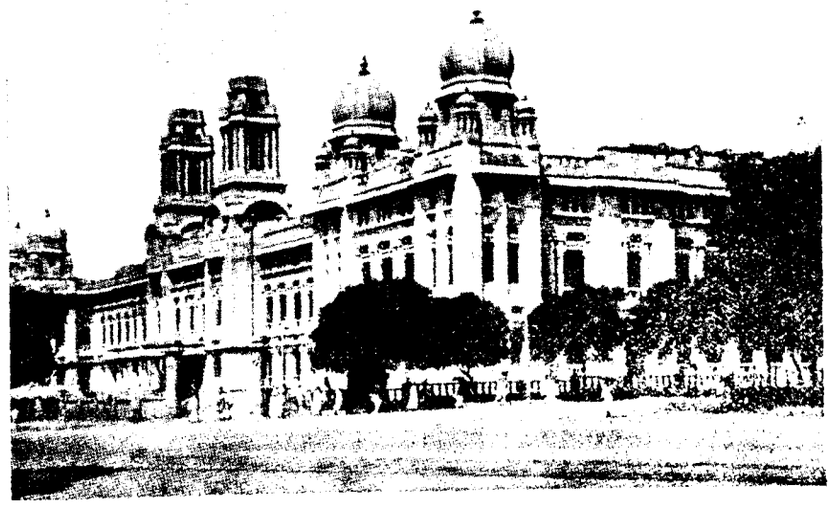


Headquarters—South Indian Railway—Trichinopoly

of Mr. Gopalaswami Ayyangar. Though the result appears simple, two years of anxious thought and exhaustive discussion have contributed to this result. During the past four decades many Railway experts, administrators, businessmen and politicians have advocated a rational regrouping of the Indian Railway system which had grown up haphazardly. Yet when the time became ripe for this development with the integration of the Indian States and the transfer of their Railways to the Government of India, some have felt dismayed at the prospect of such radical reorganisation and advised us to wait for a few years before undertaking the task. I am convinced that if such advice had been listened to, the country would have lost a great opportunity. If the numerous state Railway systems from the old Indian states had been haphazardly dealt with, new vested interests would have arisen which would make a scientific reorganisation much more difficult in the future. So the decision was taken to go ahead with the scheme."



Headquarters—Mysore State Railway—Mysore.



Headquarters—Southern Railway—Madras.

Further the brilliant pamphlet issued by the Railway Board on Regrouping of Railways throws ample light on this and the whole nation is with the Government. The lone protests are from vested interests particularly from Railway Officials who feared that their

interests will be lost in the new set-up. But a whole nation's progress cannot be held up on this score.

High-lights of the Regrouping

Hon'ble Mr. Gopalaswami Ayyangar devoted much time in explaining to those present the future set-up and advantages to be derived. Some important items are given below :—

Political integration has not solved all problems. The economic front is bristling with challenges. Efficient and improved transport at an economic cost can be assured only by the larger capacity of an integrated wider organisation. The *Southern Railway* is being launched on its new career for the purpose of achieving this objective.

A Committee of Officers one from each of the three railways presided over by a person not connected with any of them would settle the seniority of Class III employees. This Committee would be assisted by the Advisory Committee consisting mainly of representatives from Railway Unions. There will be no large scale retrenchment consequent on regrouping. Surplus men would be absorbed.

A new factory for building all steel non-telescopic coaches will be located at Golden Rock.

A new machinary for setting up a Representative Advisory Committee will be set up.

The relationship between management and workers must be intimate and a method should be devised for bringing them together at intervals in joint conferences at which confidences are freely exchanged between the two and the opportunity is given to each to understand the mind of the other also at which the management takes the trouble to acquaint workers of its plans for administrative changes and development. By submitting itself to cross-examination and criticism and accepting the useful suggestions of a practical nature coming from workers, executive officers should make the latter that they also have a part to play in the running of the concern."

The *extempore* speech of Chairman, Railway Board, Mr. F. C. Badhwar evoked the greatest applause. He concluded by saying :—

"My Colleagues and I on whom has been placed the responsibility of controlling the widespread Indian Railway system, have complete confidence that the regrouping scheme which is about to be inplemented here today and elsewhere in the near future will work satisfactorily and render effective Railway Service to the public."

This assurance augurs well for the future and Railwaymen will rise to the occasion. *Much credit should go to our First General Manager Sri K. R. Ramanujam for organising the function under his personal supervision and with the able assistance of Sri S. Ramaswami Sarma, Chairman of the Reception Committee.* The function was a success in all aspects. The General Manager assured at the close of the funotion :—

As the First General Manager who has been assigned the task of integrating the three systems and administering the integrated Railway, I take this opportunity of assuring the Ministers and the public that myself and my officers and other staff would strain every nerve to see that this Southern Railway is a model of perfection and that it plays the role that is expected of it in full measure."

After Chittaranjan, the first Locomotive factory in India, the integration of the *Southern Railway* once again reveals the manifestation of a new spirit that is surging past. In spite of difficulties we are marching on to progress. Let all of us co-operate in the mighty national reconstruction so that the future generation may bow down and say our forefathers built up a Magnificent Railway System."

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EDITORIAL NOTICE

The Editor invites contributions to the Magazine on a variety of topics—short stories, technical features written in simple English understandable to the layman, humorous articles, historical notes, &c. All copy should be brief and typed as far as possible.

Photographs illustrating social function, sports events, picnics, scenic spots etc. are also invited. All contributions should reach the Editor not later than the 25th of each month. Rejected Manuscripts will be returned provided sufficient stamps for postage are enclosed. No responsibility will be borne for copy lost in transit.

Views expressed in this Magazine should not be taken as having official authority.

All correspondence should be addressed to "The Editor, Southern Railways Magazine," Post Box No. 17, Tanjore.

SOUTHERN RAILWAYS MAGAZINE

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The Menace of the Strike Again

AT a rally of Railway Workers held in Bombay in the middle of April and presided over by Sri Jai Prakash Narain, President of the All-India Railwaymen's Federation, the challenge of an All-India strike of Railwaymen was once again thrown out to the nation. The main bone of contention appeared to be the question of a still further increase in the dearness allowance to be granted to Railway Workers in view of the upward spiralling cost of living. On this point the Railway Ministry are holding out for the reason that the demand of Railwaymen in this context cannot be considered separately, but would have to be considered from the view-point of all Central Government Workers as a whole.

It has to be admitted that the rising cost of living, coupled with the fact of food shortages, bordering almost on threatened famine conditions in some parts of the country, is a constant and gnawing anxiety in the hearts of all citizens, more especially amongst those in the middle and lower income groups.

But let every Railwayman search his heart and ask himself this question? In order to help force the Government to accede to his demands for himself as one class of worker, amongst so many others, will a vast Railway Strike help in reducing the cost of living for himself, and for the millions of his fellowmen? Another question he can think over is: What is one of the main factors to help reduce the cost of living? Obviously, increased productivity. The Railwayman's job is to help move passengers, goods and merchandise from one part of the country to another, and perhaps most important at this stage, to help move essential foodgrains from surplus to deficit areas, efficiently and speedily.

If the Railwayman can honestly say that he is putting forth every ounce of his body, brain and mind in increasing Railway productivity, that is, mainly the movement of commodities in the shortest time physically possible, and that he has done his bit in helping to reduce the cost of living, then he has every right to resort to the final weapon of the strike.

But what effect will even the mere thought of an impending strike have on the average Railwayman. Before the thought becomes

(Continued on next page bottom)

THE PRODIGY

The amalgamation of the Mysore State, South Indian and M. S. M. Railways into the newly formed Southern Railway Zone was inaugurated on 14th April.

action a nervous tension will be surging. Throughout all Railways in the land a kind of spirit of resentment will be surging through their hearts, and men nursing resentments will never be able to put forth even their second-best in their jobs. Instead of the essential commodities, especially in the way of foodgrains, moving faster, they will be moving slower because of the possible drop in efficiency. And the millions of men, women and children, in the deficit areas will be waiting and waiting hungrily for those more abundant supplies of food which they need so sorely.

Will there be a blessing for the Railwaymen from the hearts of their fellowmen and women, or a curse? Before the Railwayman thinks out his answer let him also remember that in those very deficit areas are perhaps not only his friends or fellowmen, but his kindred too.

Inauguration of Southern Railway

Hon'ble. Sri N. G. Ayyangar delivering his inaugural speech. Mr. F. C. Badhwar, Chairman, Railway Board, is seen on the left of Hon'ble. Sri K. Santhanam

H. E. Governor of Madras delivering his presidential address

Inauguration of Southern Railway

Mr. Sadagopan, Dy. Director (Finance) Railway Board, is seen here in the centre

Mr. L. R. Natarajan, Dy. General Manager, (Personnel) (now on the re-grouping committee) is deeply engrossed in a conversation

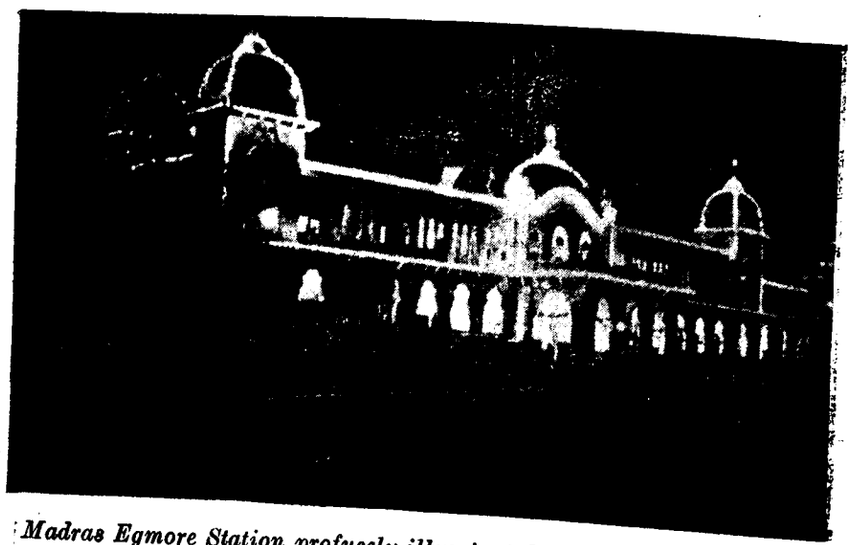
Inauguration of Southern Railway

Mr. C. R. Srinivasan, Editor, Swadesamitran, and Mr. K. R. Ramanujam, General Manager, Southern Railway are seen here chatting

Mr. V. Neelakantan, Member for Staff, Railway Board, is posing for the snap

Inauguration of Southern Railway

Mr. Narayana Ayyangar, Electrical Engineer, Southern Railway, is in an hilarious mood



Madras Egmore Station profusely illuminated on the inauguration day

Our London Letter

By A Correspondent

THE Festival of Britain is being opened by the King on May 3rd. The festival site on the south bank of the River Thames has given London a new skyline, a pleasant change from the dreary blocks of old houses, deserted warehouses and other eyesores. A few miles away, also on the south bank, is the beautiful site of Battersea Park which is also being used for the Festival of Britain. Of interest to Railwaymen is the freak Railway that is to convey visitors to various places of amusement in the park. This is the S and B Railway with a capital of £12.000 and is a 15" gauge miniature line with three stations. The Railway is now to be known as the Far Twittering & Oyster Perch Railway and it has been designed by a cartoonist named Rowland Emett. Closely resembling Heath Robinson's work, the locomotives and carriages are all specially built to emulate that style. There are three engines, Nelly, Neptune and King George III.

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The Festival of Britain commemorates a similar event which occurred one huudred years ago. This was the Great Exhibition of 1851 whose huge glass palace was erected in Kensington Gardens and subsequently re-assembled at Sydenham and then called the Crystal Palace. It was designed by a Railway Director named Joseph Paxton. And oddly enough few people know that the turret clock that adorns Kings Cross Station in London, was orignally exhibited at the Great Exhibition of 1851. It is a three faced clock and at the time it was exhibited it became the talk of London because its hands moved by half seconds and not by seconds! Until 1924 it was a chiming clock and possessed three bells one weighing 29 cwt. which were also exhibited in the 1851 park exhibition. It is now electrically controlled.

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The Siemens & General Electric Railway Signal Co. of London have received a contract for the supply and installation of automatic signalling and interlocking equipment on the Yonge Street Subway now under construction for the Toronto Transport Commission. The contract will be carried out in conjunction with the Company's Canadian representatives, Radio Engineering Products Ltd. of Montreal who will be responsible for the installation under the supervision of British engineers, This is the first Railway signalling contract to be secured by a British firm in Canada. The value of the work is approximately 1,200,000 Canadian dollars and is to be completed in about 2½ years.

The main items of equipment to be supplied will consist of automatic colour light signals, electric point machines, electrically operated train stops and three relay interlocking panels for the control of signals and points from signal boxes, All the relays for this work will be of the plug in type.

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The Railway Museum at York, the largest in England entirely devoted to Railway subjects, took its rise on the North Eastern Railway in 1922. Two North Eastern Railway Officers, Mr. J. B. Harper, Assistant Superintendent and Mr. H. J. Rudgard, Assistant Engineer for Maintenance, used to pick up a

A priceless Exhibit in the York Railway Museum is the Hetton Locomotive built by George Stephenson and Nicholas Wood in 1822. Behind the Hetton Engine is displayed the Weatherill Winding Engine of 1833, used to haul cars up one of the inclines in Northern England.

Trial trip of one of the Emett trains which will run at Battersea Park during the Festival of Britain.

lot of quaint objects as they went about the line on their lawful occasions. Their collection interested Mr. E. M. Bywell, who was then Editor of the N. E. R. Magazine, and early in 1922 he suggested that they would form the nucleus of a Railway museum. A committee was set up with Mr. Harper as Chairman and roused the departmental officers and individual members of the staff to join in the hunt for curiosities. Sufficient small articles were gathered together to fill a room in the York Headquarters Offices and in the autumn of 1922 a large shed at Queen Street, York, was earmarked for rolling stock and permanent way specimens.

The museum went on growing after amalgamation and by the year 1928 it was firmly established as a North Eastern Institution. Great credit is due to Mr. Bywell who has been curator for nearly thirty years. There is now a proposal afoot for a redistribution of Railway exhibits between a new British Transport museum at Nine Elms (London), the York museum and other museums at Euston and in Edinburgh and Cardiff. The large exhibits section includes twelve full size locomotives of the greatest historical significance ranging from a colliery engine built by George Stephenson in 1822 to the first G. N. R. Ivatt Locomotive.

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The largest ornamental ceiling of its kind in the world, in the Geat Hall at Euston Station, is to be redecorated to a colour scheme proposed 105 years ago by its designer P. C. Hardwick. The first portion of the coffered ceiling will be in light blue and the remainder of the ceiling and walls will be in shades of cream. The column shafts, which Hardwick intended to be marbled to represent red granite, will be in Tuscan red with gilt capitals and bases. Modern tubular scaffolding is now being assembled in the hall for the work and if this were joined and to end it would reach to the top of Mount Everest—six miles. The only other ceiling in the world like Euston, which has no supporting columns, is at Buckingham Palace.

Euston Great Hall is the central feature of a block of buildings designed by Hardwick and built in 1846. The accommodation problem at Euston became acute after the London & North Western Railway amalgamation and in this and the following year the new company erected the large central block of buildings which now faces the traveller entering through Euston's famous Doric Arch. This block included booking offices on each side, two upper floors for the departmental staffs, the shareholders' room, the board room, committee room etc. The main feature of the new building, as it is now, was the Greal Hall which may be regarded as a piece of architecture even more impressive than the Doric Arch,

It is the largest waiting room in the British Isles—being 128 feet long, 62 feet wide and 64 feet high. This ceiling is the largest of its kind in the world and is copied from the roof of St Paul's outside the walls, Rome. In the corners are base reliefs 10 feet by 7 feet each, representing Birmingham, London, Northampton, Chester, Manchester, Carlisle, Lancaster and Liverpool. When it was last redecorated, under the supervision of the late Sir Edward Lutyens, the famous architect who designed New Delhi, the complete work required over two tons of paint and cost then over £1000. A statue of George Stephenson was placed in the hall in 1852.

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(Continued on next page bottom)

Cylinder Lubrication of Steam Locomotives

THE greatest number of locomotives in service are still steam operated, despite the fact that in the United States of America and elsewhere present replacements are practically all of the diesel electric type.

The steam cylinders of locomotives require a lubricating oil film between the metal surfaces of the pistons, rings, and cylinders and the rubbing surfaces of the valves and rods to minimize friction and prevent wear and destruction of the surfaces. The lubricating oil film also acts as an effective seal between rings and cylinders to reduce blowby and consequent loss of power and economy. In locomotive operation, the loads and speeds vary abruptly between maximum and zero. Unlike stationary steam engines, air is drawn into the steam cylinders in some designs of units during the drifting period. Oxidation of the lubricating oil, therefore, becomes a factor to be considered when such conditions exist. During the drifting period, abrasive or corrosve materials may also be drawn into the steam cylinder from the smoke box through the exhaust passages.

Steam valves on locomotive cylinders are ordinarily the piston or slide type. The valve sliding surfaces are lubricated by the oil in the steam on its way into the cylinders. Some locomotives are equipped with double beat poppet valves which provide independent control of admission and exhaust of the steam. There are no rubbing surfaces on these valves to lubricate, but the valve stem and valve gear links and cams must be lubricated.

Lubrication of steam cylinders is affected by pressure and temperature of steam, amount of moisture in the steam, and by contamination or deposits. The various effects of these conditions must be understood in order to secure the optimum results in lubrication.

EFFECT OF PRESSURE

Steam pressure is a factor that results in wear between the internal moving parts, unless they are properly lubricated with an oil that can resist the severe squeezing and rubbing action at the operating temperatures encountered. High pressure forces the rings tightly against the thin film of lubricating oil that is on the cylinder wall, and against the sides of the piston-ring grooves. This pressure is greatest at the ends of the cylinder where the steam is hottest, and where the severest duty must be performed by the lubricating film.

Although complete prevention of metallic contact in steam cylinders is difficult, lubrication can still be maintained and wear can be minimized, as long as the microscopic lubricating films cling to the cylinder walls. Where this condition of boundary lubrication exists, the adhesion of the oil to metal determines the degree of protection afforded. Such metalbonding ability (film strength) depends upon the quality of the oil, and the quality and amount of compounding that for best results, a locomotive steam cylinder oil should have.

In the case of saturated steam, increased pressures are accompanied by correspondingly increased temperatures, which decrease the load-carrying capacity of the lubricating films. Hence, for saturated steam, either the pressure or the temperature of the steam might be used as a basis for selecting an oil of proper viscosity higher viscosities being required for increased pressures and temperatures.

Where superheated steam is involved, however, the temperature is higher than the temperature of saturated steam at the same pressure. If an oil is suitable, therefore, for cylinder lubrication at a given saturated-steam pressure, it may be unsuitable for use with superheated steam at the same pressure, because the higher temperature may thin the oil excessively and reduce its load-carrying capacity sufficiently to permit metallic contact. Moreover, the higher temperature may also deteriorate the oil, so that its value as a lubricant is impaired and deposits may be formed. However, if an oil is suitable for cylinder lubrication at a given steam temperature, either saturated or superheated, then it is also adequate to lubricate the cylinder under the highest possible steam pressure that can exist at that temperature. For this reason, the selection of steam-cylinder oils on the basis of steam temperature will assure effective lubrication under all pressure conditions.

EFFECT OF TEMPERATURE

Steam temperature and the consequent cylinder temperature affect lubrication in several ways, i. e., by reducing oil body, adhesiveness and load-carrying capacity, and by increasing the rate of oil oxidation on the cylinders, valve stems, piston rods, and in the piston-rod packing glands.

Unless a properly selected oil is used, the temperature in the cylinder may be so high that its lack of body and adhesive properties permit the rings, valves,

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Train services between Princes Risborough, Buchinghamshire and Watlington, Oxfordshire were suspended until March 17 because a Railway fireman A. V. Benham of Chinnor was granted twelve days' leave to get married. There was nobody to carry on his job his relief having been called up. Four trains run daily, with five on Saturday, from Princes Risborough to Watlington and five daily with six on Saturday in the reverse direction. To meet the emergency passengers were carried at normal train times by buses.

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No. 70001, the second of the British Railways "Britannia" class standard mixed traffic locomotives, was named *Lord Hurcomb* at Liverpool Street Station on March 6th. The naming of the first of the class *Britannia* by the Minister of Transport on January 30 was described in the last issue of this journal. Lord Hurcomb, Chairman of the British Transport Commission, was invited by Mr. John Elliot, Chairman of the Railway Executive, to unveil the nameplate. He said that he accepted the compliment of having the second standard locomotive named after him not as paid to him personally but through him to all the 890,000 employees of the British Transport Commission. The introduction on the Liverpool Street main line services of the "Britannia" class locomotives, the largest and most powerful yet put into service on the former Great Eastern system, would enable the service to Idswich, Norwich and the Norfolk coast to be substantially improved.

and packing to partially scrape the lubricating films off the cylinder walls, valve stems and rods, thus leaving the metal surfaces exposed to wear. Furthermore, the deficient sealing ability of such an oil allows steam to blow past the rings, valves, and packings, and to scour away more of the lubricant, thus causing increased wear. High steam temperature, therefore, tends to decrease the ability of lubricating films to protect the moving internal surfaces, and makes it necessary to use a heavy-bodied oil that has adequate adhesive properties at the temperature to which it is exposed. Some oils, by virtue of their exceptional attraction for metals, retain to a greater degree than others the ability to adhere to rubbing surfaces, even after high temperature has thinned their body.

Piston-rod lubrication must not only protect and seal the contact surfaces between the rod and the packing rings (as well as the surfaces between the rings and the slots of the gland), but must also assure complete freedom of the rings in their slots. A suitable oil, therefore, must be especially resistant to oxidation and the consequent formation of gum and carbon. Moreover, since a restricted feed is desirable in order to minimize the accumulation of deposits, the oil must be capable of protecting the rubbing surfaces even though fed at an exceedingly low rate.

EFFECT OF MOISTURE

Moisture in a steam cylinder may affect lubrication if the water actually wets the metal and "floats" the oil away, so that the lubricating film no longer adheres to the rubbing surfaces. Moreover, water blown at high velocity across the cylinder wall washes away unsuitable oil, making it difficult to minimize wear even with liberal feeds. Under wet steam conditions therefore, ordinary mineral oils furnish adequate protection only when fed in excessive quantities.

In order to resist the washing effect of moisture in steam cylinders, it is necessary to use a cylinder oil that combines with water and forms a lubricating emulsion. Properly controlled, this emulsion will be adhesive, and high in film strength.

The degree to which oil-wet surfaces can be maintained by a cylinder oil depends, not only upon the character and quality of the mineral oil, but also upon the percentage and nature of the compound it contains.

Since locomotives operating normally at high superheat will have saturated steam for starting and for various low load conditions, a cylinder oil selected for superheat service will also need to be suitable for saturated service. Compounded oils are, therefore, the most desirable for locomotives using superheat as well as saturated steam.

DEPOSITS

Oxidation is a factor in the lubrication of locomotive cylinders since air may be admitted freely into the cylinders during drifting. Under such conditions, oils of the highest possible quality and of the greatest resistance to oxidation are required.

With elevated steam temperatures, when the pressure is abruptly dropped to atmospheric and air admitted to the cylinder, the metal of the piston and cylinder will still be very hot. The thin oil film will tend to vaporize and leave the metal surfaces. Since no more oil is being spread on these surfaces at these times, they may become dry and void of the protecting oil film. The cylinder oil must have maximum resistance

to destruction under such conditions.

During these drifting periods, a vacuum is created in the cylinder and corrosive and abrasive materials are drawn into the cylinder through the exhaust from the smoke box. The presence of excessive oil on the cylinder surfaces would tend to act as a binder for such dirt and cause build-up of abrasive deposits. The correct cylinder oil must therefore be capable of protecting the rubbing surfaces even though in a thin film, as secured by minimum feeds.

METHODS OF APPLICATION

When the design and the operating conditions are known, the correct oil can be selected to meet these requirements. It then becomes necessary to be certain that the oil is applied in the correct quantities and in the most efficient locations so that good distribution is secured over the surfaces to be lubricated.

There are two classes of lubricators employed for introduction of valve or cylinder oil to the internal parts of a steam locomotive, namely, (1) the hydrostatic lubricator, (2) the mechanical force feed lubricator.

The hydrostatic lubricator is located in the cab of the locomotive, and is at all times in view and under the control of the engineer or fireman. The operation of the lubricator depends upon the oil within the lubricator being displaced by water condensed from steam, which is admitted by a pipe leading from the boiler. The flow of oil is controlled by the adjustment of needle valves.

When a mechanical force feed lubricator is used, it is located near the locomotive cylinders, and consists of an oil reservoir, with several diminutive positive-acting plunger pumps, which are mechanically operated by a mechanism operated from the same moving part of the engine. The plunger pumps are so designed that the quantity of oil discharged can be regulated. After adjustment, this type of lubricator requires no further attention than filling.

It should be observed that the hydrostatic lubricator feeds oil uniformly with respect to time, i. e. a constant number of drops per minute, and that, therefore, an engine running at high speed receives less oil per revolution than when running at relatively low speed, unless re-set by engineman.

The mechanical force feed lubricator, on the other hand, may be made to feed oil at a constant rate with respect to the revolutions of the driving wheels, i.e., to feed one drop of oil for every so many strokes of the piston. Relatively speaking, this type of lubricator then supplies more oil while the engine is running at high speed than does the hydrostatic lubricator. By driving the lubricator from a part of the valve gear that has a variable motion, the rate of feed may be made to vary accordingly.

Drifting operation that permits access of cinders from the smoke box to the cylinders is a condition that renders satisfactory lubrication exceedingly difficult. Oil is a binder of the impurities which can be only made more serious by the use of an oil of unusually heavy body. It is frequently the practice to keep the throttle slightly opened when the engine is drifting, in order to provide steam to atomize the oil, also to avoid drawing in cinders from the smoke box.

Operation of Railway Points by Power

By H. C. Towers, M.I.E.E., M.I.R.S.E., M.Inst.T.

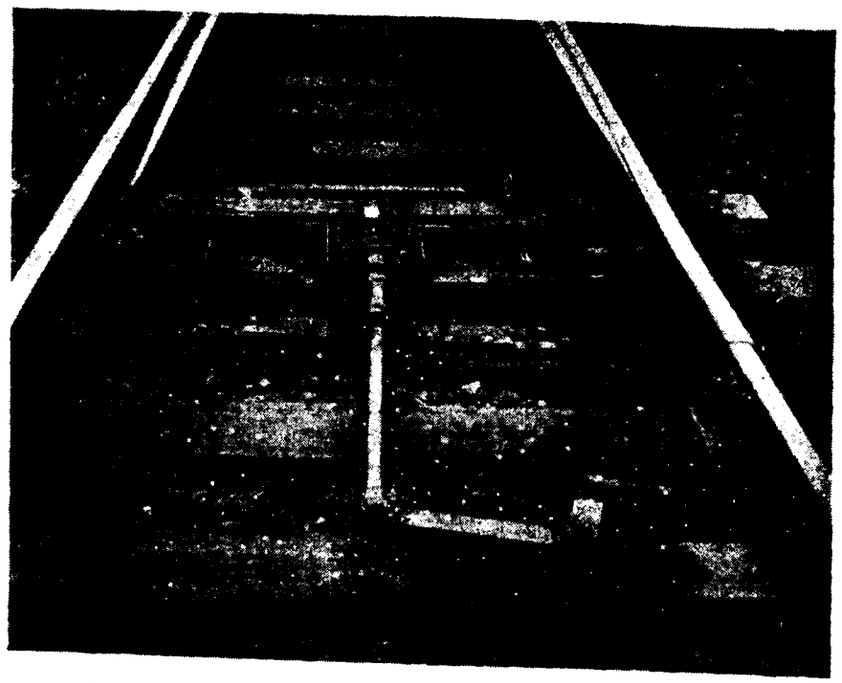
Dy. Chief Engineer (Signals) B. B. & C. I. Railway

THE idea of operating Railway switches or points by power originated more than half a century ago. In all branches of engineering there must be constant development and progress and there are always some, where advance is more rapid than in others. The same remarks apply to the application of electricity to Railway signal engineering. The last thirty years has brought a very rapid advance in this subject and particularly so in the few years preceding the second world war and those that have followed after it. This article is intended to cover a very small part of this section of Electrical Engineering—operation of points by power instead of the usual manual method.

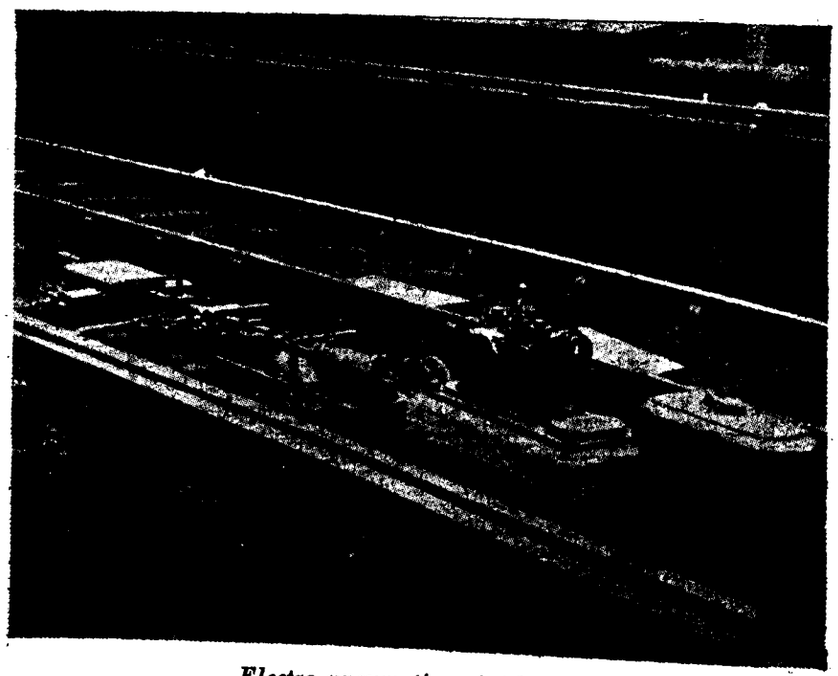
Mr. H. C. Towers

The term points covers the two switches which are used to change the direction of vehicles from one line to another. One is referred to as the "closed switch" and the other the "open switch." Both switches are rigidly coupled together so that only one can be up against the stock, or main rail, at a time. During the infancy of railways, points were crude affairs. The switches were roughly manufactured and joined together by a form of rod worked by a hand lever near the points. In 1860 the U. K. Parliament framed regulations that all points over which trains passed in a facing direction must be equipped with facing point locks and locking bars. The locking bars were made longer than the longest wheel base in use and the facing point lock could not be withdrawn, to unlock the points before they were moved to the opposite direction, until the bar was thrown. The bar is attached to the rail by means of rockers and has to travel through an arc the highest portion of which brings it higher than the crown of the rail. It follows that if a train is passing over the points, the wheel flanges would hold the bar down and prevent the lock from being withdrawn. The points were thus held in position until the train had passed clear of them.

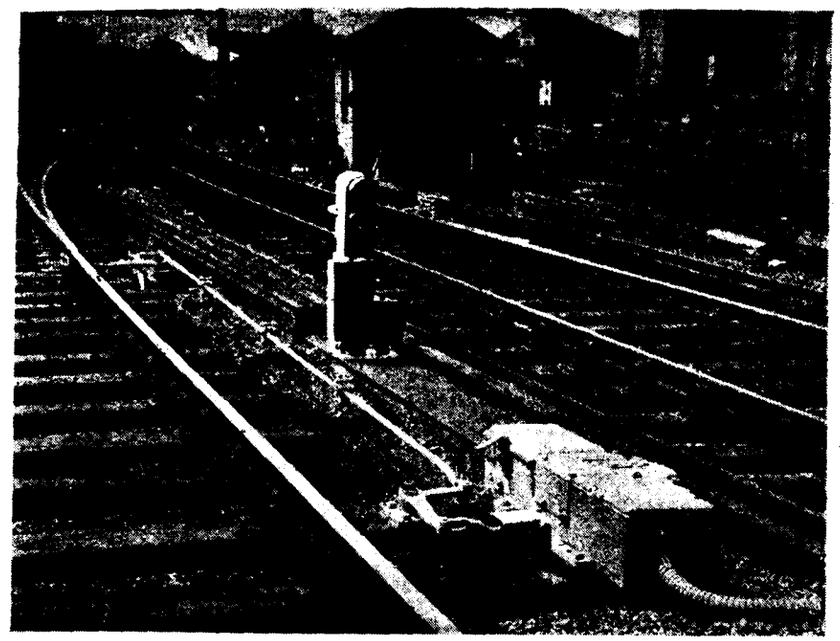
In course of time the levers operating the locks and points were concentrated in a lever frame and very soon interlocking was designed to make conflicting levers interlock each other. Soon after this signal levers were added so that the whole installation could be worked from a central site and conflicting functions interlocked with each other. The first interlocking frame was put down at Corbetts Lane Junction in 1839, on the London and Greenwich Railway.



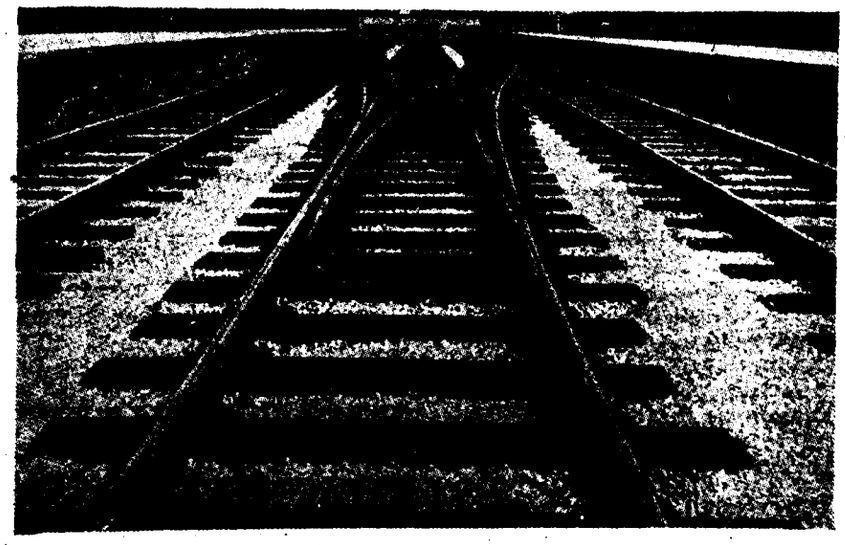
Points operated manually by rodding but with electrical detection.



Electro-pneumatic point layout



All electric point machine



Well laid track and switches

There are still very many installations in Great Britain and overseas where signals and points are worked manually. The type of lever frame has been under constant development bringing levers with larger stroke. This had enabled signals and points to be operated from a greater distance but this value is still strictly limited by the signalman's strength since the whole force required for driving

the point rodding and operating the switches is derived from physical exertion. This again has a limiting factor on the speed of the installation particularly where a heavy train service has to be worked. Towards the end of their shift, signalmen must necessarily become tired with corresponding slow down in their movements.

There are two advantages in operating points by power. The first is that the distance from which they can be worked from a signal cabin is unlimited and the second is speed in operation. The first power worked points were put down in England at the commencement of the present century. A few railways experimented with hydraulic plant but compressed air found more favour.

With air operation, the point switches, locking bar and facing point lock are driven by a compressed air motor consisting of a simple cylinder driving a piston backwards and forwards. The rod is attached to the point connection. Admission of air to one side of the piston drives it one way and vice versa. Air to the point cylinder is controlled by an auxiliary motor. This consists of two small pistons operating a slide valve. This valve controls the admission of air from the air main to the point motor. The auxiliary is provided with two electro-magnets one for normal and one for reverse and these magnets control the auxiliary pistons which work the slide valve. The magnets are connected by line wire to the point lever in the signal cabin.

The sequence of operation is as follows: If the point switches are lying normal and are required to be reversed, the point lever is placed in the reverse position. The normal magnet is de-energised and the reverse magnet energised. The reverse auxiliary cylinder becomes charged with air at the asme time as air supply is cut off from the normal side. The revers piston pushes the slide valve ove at the same time pushing th normal. The slide valve has now connected the air main to the pipe leading to the reverse side of the point motor while the normal pipe is now connected to atmosphere. The main piston is forced from normal to reverse, driving the point operating gear, while the air in the cylinder on the normal side is forced back through the normal pipe to atmosphere, the escape port being opened by the passage of the slide valve from normal to reverse.

It was necessary to ensure that the points had correctly responded to lever movement and that they were locked and this was arranged by fitting a contact box operated by the point movement. This released electric locks on the point lever in the signal box there being one lock for the normal movement and one for the reverse. These locks prevented the final or indicating movement of the lever so that if the points had not operated correctly the point lever could not be replaced fully normal or reverse which prevented the signal lever working signals reading over the points being cleared due to the mechanical interlocking between the levers. Even in the early days of power point operation, the signals were also operated electro-pneumatically, and the line wire controlling the signal was taken over contact boxes on the points.

Modern electro-pneumatic point layouts in use today follow much the same principle and except for improvement in the design of point cylinders and auxiliaries the principle remains unchanged. Originally, the point piston was fitted with leathers but these were found to be unsatisfactory. The leathers wore and air leaks occurred and where a large number of points were involved the air loss was serious apart from maintenance problems. In

the improved designs the leathers have been removed.

With the advent of track circuiting, the locking bar was removed and the point lever is today locked by the track circuit passing through the points. If the track circuit is occupied the point lever is locked in whichever position it happens to be placed. The contact boxes on the points have been displaced in favour of a combined switch and lock detector. This detects, to a very fine limit, that the point switches are correctly positioned and locked. It reverses the polarity of an electrical circuit operating a point detection relay in the signal cabin. The point switches have to be correctly set and locked, either normal or reverse, before the point detection relay is energised. The indication lever locks and the signal control circuits are taken over contacts on this relay.

In all electric point operation the point switches and locking device are driven through gears by means of an auxiliary device known as a point contactor or controller which is really a polarity switch. This reverses the polarity of the motor and it is controlled by a magnetic device operated by current received from the point lever in the signal cabin. Both AC and DC point operation are in use at the present time and the latter method is more usual where a power supply is not readily available. Here primary batteries are used and this method is often found in centralised traffic control systems which are extensively used in the USA and New Zealand.

The question of whether electro-pnuematic or all electric point operation is to be adopted depends largely on the policy of of the signal engineer concerned and the type of installation to which it is to be applied. On the Railways of London Transport, electro-pnuematic operation is used exclusively, not only for point operation but for automatic train stops and other auxiliary devices. Here a signal air main runs throughout the length of the line and it is supplied at intervals en route from the traction sub-stations. For isolated installations a compressor house and air reservoir tanks are necessary with the attendant running costs. Where electric lighting mains are in service these can be stepped down to the standard working voltage of 110 Volts and used for operating point machines, signals, track circuits, etc. The expense of a compressor house, plant and air main are avoided.

It has been claimed that all electric operation is slower than electro-pnuematic, the former method taking longer for the switches to change from one position to another. While this may be considered immaterial where a few points only are concerned, the time lag may be accumulative and quite serious in large station yards where many points have to be set for the passage of a train. Frequently these points work in sequence, that is, one has to be set and locked before another movement can be initiated. With the indication locks checking the final movement of a lever, the signalman has to wait for one indication to be received and the point lever placed fully normal (or reverse) before the next lever can be pulled, if there is mechanical interlocking between them. Some Railways dispense with the indication lock entirely on the grounds that this slows up the working and that in any case no signal can be cleared unless all the points are correctly set and locked their circuits being controlled by the point detection relays. The question of whether or not this is good practice is a matter of opinion which is outside the scope of this article.

Electro-pnuematic power signalling came to the west coast of India in 1927 when Victoria Terminus, G. I. P. Railway, was converted to electro-pnuematic operation and colour light signalling. Two power frames of 131 and 71 levers were installed. Another installation was opened at the new Bombay Central Terminal of the B. B. & C. I. Railway, in December, 1930 with a power frame of 119 levers. Two compressor house, adjacent to the signal cabin, houses two Sentinel two stage compressors made by Alley & Maclellan Ltd. and driven by 10 h. p. induction motors. They cut in when the pressure drops to 60 lbs. per square inch and cut out when it rises to 70 lbs. The motors work on alternative supplies. Owing to being situated in the tropics the cooling water temperature could not be kept down to 100°, as recommended by the makers, and a Heenan water cooler was installed. A 67 feet air storage tank is located outside the compressor house. The point motors have steel piston rings owing to the difficulty in obtaining grease that would not harden point leathers. All the point layouts are fitted with the modern cut off type point valve, attached to the auxiliary motors, so that no air is connected to the points except during point operation. Loss of air by leaks is thereby reduced to a minimum. 73 electro-pnuematic points, over an area of about one mile, are worked by this system.

This is the only electro-pneumatic installation used on the B. B. & C. I. Railway. Power signal installations at the suburban city terminal at Church gate, at Bandra and at Mahim, with power frames of 23, 50 and 101 levers respectively, have all electric point layouts and these were installed during the years 1931 to 1935.

Stop watch observations on the time taken for a point lever to be operated from normal to reverse, and vice versa have revealed that there is little difference in speed between electro-pnuematic and all electric operation. At Bombay Central the time observed was 2·5 secs. and at Mahim and Bandra 3 secs. Indication locks are used in all cases.

Where complete track circuiting exists, points can be made to change their position automatically by the actual passage of the trains. Two such installations may be found at Liverpool Central, on the Mersey Railway, and Bank station on the Waterloo and City section of British Railways, Southern Region. Here the layouts are simple consisting of two platform lines connected by crossovers for reversing the trains. A small signal cabin is provided in both cases and contains a King Lever for automatic operation. When the lever is reversed, the cabin is closed and the installation works automatically. When a train stops in the platform, the platform track circuit causes a time relay to function. After an interval of 30 secs. or such period as may be determined, the points reverse automatically and the signal permitting the train to leave the platform is "cleared." This system does not require signalmen to be on duty for manning the signal box but which is, at the same time, available for emergencies when automatic working cannot be used or is not desirable.

It is with narrow souled people as with narrow necked bottles; the less they have in them, the more noise they make in pouring it out.—POPE.

Steel Fastenings

By Eless

The following is an article contributed by an eminent writer who has actually visited the Workshops of Messrs. Guest, Keen, Williams, Ltd. in Calcutta. The firm hardly needs any introduction to our Indian Railways and Railway Engineers in particular as they are the biggest manufacturers of Permanent Way Fittings such as Steel Rivets, Bolts, Nuts, Rail Anchors, Set Screws, Loose Jaws, Dogspikes, Machine Screws, Keys, Tiebars, Cotters, Gibs etc. In the following paragraphs the writer describes in a simple style as to how the above steel products are manufactured. The rapid industrialization of India underlines the importance of this secondary industry which is concerned with turning out such fittings as stated above. We would specially invite the attention of the Ministry of Railways to this article and would suggest to consider the possibility of utilizing the process known as "THERMIT–FUSION WELDING" for Rail joints as this would go a long way in lessening the saboteur's chances of success and thereby averting Rail disasters as far as possible.—ED. S. R. M.

THE term "steel" generally conjures up in the minds of most people visions of bridges, buildings, ships, locomotives and wagons and few people are aware of the large amount of steel used in the manufacture of small articles in daily use.

From experience, it has been found that approximately 60% of the major steel producers' output requires some form of fastening and it is estimated that in India the annual demand for bolts, nuts, rivets and spikes alone is in the neighbourhood of 30,000 tons. It will be appreciated, of course, that to obtain this tonnage of fastenings a considerably greater tonnage of semis is required.

"Semis" take the from of sheet bars, slabs, blooks and billets and the form of semis required for the production of these fastenings is, usually, billets. It is not the purpose of this article to explain the various processes in the production of billets from the ore or from the ingot but rather to give a picture of the manufacture of the fastening from time the billets are delivered to the rolling mills.

There are a number of concerns in India engaged in what are usually termed "secondary industries" and which manufacture bolts, nuts etc. and the writer had an opportunity recently of visiting the works of largest manufacturer of these fastenings in India.

To produce Bolts, Nuts, Rivets, etc. to the recognized and accepted specifications, it is essential that the bars from which these articles are made are rolled to special limits and in the works visited, every care is taken to ensure that all the finished articles produced there are in accordance with these specifications. Inspection is necessary at various stages of manufacture in order to ensure that the finished article strictly conforms to those specifications.

INCREASING DEMAND

Immediately prior to the 1939–45 war, large supplies of mild steel billets were obtained from Australia, but during the war practically all the billet requirements were supplied fron the Indian steel works and both of the major steel producing companies in this country co-operated to the fullest extent in endeavouring to meet the demands for billets required in the manufacture of fastenings. It is, of course, obvious that there is

little to be gained in producing steel plates or sections such as joists, channels and angles, unless the means of fastening them are also produced, and while both electric and oxy-acetylene welding are being largely used, the demand for bolts, nuts and rivets and for permanent way spikes is still considerable. As India becomes more industrialized, it is anticipated that the demand will continue to increase.

The rolling mills at the works mentioned can handle between 4,000 and 5,000 tons of steel billets every month, and their plant for manufacturing bolts, nuts, rivets and spikes is capable of producing approximately 2,500 tons (finished weight) per month. For various reasons, it has not yet been possible to obtain this maximum production, but there are other concerns in India which also produce these articles and between the various manufacturing units, the demand in this country could be met if sufficient supplies of the required steel were available.

The steel billets obtained are of varying analysis. It will be realized that exceptional care is necessary in ensuring that the various specifications do not become mixed. The carbon content of the billet varies from ·08% to 1·2% and for the manfacture of bolts, nuts, rivets and spikes the steel generally used has a maximum carbon content of about ·25%. A higher carbon steel of about ·35—·40% has, however, to be used in the manufacture of bolts and nuts required in connextion with fish-plates and railway points and crossings.

All the billets are tested at the steelmaker's works and are marked with cast numbers. In addition, the ends are painted with different colours to distinguish one quality from another. Test certificates are supplied by the steelmaker showing the analysis and, occasionally, the tensile strength of the steel. These billets on arrival at the re-roller's works, are sheared to lengths to suit the size of the mill furnaces and according to the size and section of the bars to be rolled.

'HOT AND COLD' PROCESSES

The range of sizes of bolts, nuts and rivets generally produced in India is from 1/4" diameter to 1.1/2" diameter inclusive—up to and including 1/2" diameter by the "cold" process and the larger sizes by the "hot" process—while dog-spikes are made from a square section. The smaller diameters of rods are coiled after rolling but they require further treatment before they arrive at the cold heading machines. These coils are pickled and annealed and then drawn to even closer limits than the rolled bars.

The expression "hot" and "cold" requires explanation. Practice and experience have shown that bolts and nuts, set screws and machine screws up to and including a diameter of 3/4" can be formed from the bar without heating it in order to produce ductility. It is at once obvious that to produce a small diameter bolt, nut or rivet is a much simpler operation than producing one of a larger diameter —say 1". This would lead one to assume that the cost of the smaller diameter bolt, nut and rivet should be considerably less than the cost of one of larger diameter but this, however, is not necessarily the case.

To produce the article from a "cold" bar or rod special automatic machines are necessary. These machines which are known as cold heading machines are fed by rods which in the form of a coil, are placed on a stand close to the machine and by a double action which takes place almost simultaneously, they cut the rod to the

required length and form the head of the bolt or rivet. In a similar manner, "cold" nuts are manufactured from a flat section of bar and these bars are fed to nut forming machines, which punch or blank out the size of nut required. Both these operations can be likened to shelling peas.

THREAD ROLLING

After the bolts are "formed" they are then transferred to thread rolling machines. These

machines have two thread rolling dies fitted opposite to each other, one being fixed and the other on an arm wnich moves up and down in the same plane as the fixed die. The blank bolts, are fed to a hopper at the top of the thread rolling machine and by gravity, they fall into a shute from which they are carried down into the the space between the two dies. The reciprocal action of the dies rolls the shank of the bolt down the dies and at the same time "rolls on" the threads.

Bolts manufactured by the cold heading process, which is briefly described above can always be easily recognized as compared to a bolt manufactured by the "hot" process as the "rolling on" of the threads has an extrusion effect on the shank of the bolt which gives the end of the bolt a slight concavity.

It will be obvious, therefore, that to manufacture bolts and nuts by the cold heading process, a heavy capital outlay is necessary as the machines on which these articles are produced are of a complex nature and require constant supervision and maintenance. In addition to this, the rods or bars have to be processed to a much greater degree than those utilized for the manufacture of bolts and nuts by the "hot" process. These and other factors have, of course, an important bearing on the final price of the finished product.

In India, where bolts and nuts over 1/2" diameter are manufactured by the "hot" process the human element is of greater importance than in the semi-automatic production of the smaller sizes. The rolled bars are drawn from the stockyard and sheared to the lengths required, leaving sufficient on the "stock" or "pin" to allow for the forging of the head. The pins are then heated to the required temperature in an electric or oil fired furnace and when the required temperature has been reached, the pin is placed vertically in a forging machine which delivers one or two blows thus squeezing the hot metal to the shape desired for the head.

SKILLED JOB

The operator has to be very skilled as well as rapid in the handling of the pin, as it cools very quickly after being withdrawn from the furnace and any delay on the part of the man on the job would cause unnecessary wastage of time and material. It is an interesting sight to watch the forgers at work. They are usually men who have followed this particular trade throughout their lives, and the rapidity with which they manoeuvre the red-hot pins, is remarkable.

After the head has been formed, the bolt and rivet have the fins removed from the head and after inspection, the bolt is ready for threading. In this case, the threads are cut on the shank as distinct from being "rolled on" as has been described in the "cold" process. The operation of cutting the thread is again carried out by manual means.

Nuts over ½" are also forged "hot" and are sent to the screwing department where they are tapped in accordance with recognized specifications. The bolts and nuts are then "buttoned," i. e., each bolt is fitted with a nut, after which they are oiled and packed in gunny bags ready for despatch throughout the whole country.

It was only to be expected that in the first few years of bolt and nut manufacture in India, many teething troubles were experienced. It was found that the local labour was not capable

of operating the few machines available at that time and it was a long time before production commensurate with the capacity of the machines was reached. In addition to this, the bars supplied to the bolt and nut fabricators were not to the close limits required for the production of these fastenings. The troubles were eventually overcome, but it was not until the early part of the 1939–45 war that bolts, nuts, rivets and spikes started to come off the production line in quantities sufficient to meet India's needs. Until this time very few machines were available in India, permitting the manufacture of bolts and nuts of ½" diameter and under, and it was only in 1943 that, assisted by the Government of India, the necessary machines were obtained, enabling this country to produce the smaller sizes in sufficiently large quantities. It was evident to the Government authorities that India must endeavour to be self-supporting in the indigenous production of bolts, nuts and rivets manufactured by the "cold" process.

Rounds, flats and squares are rolled for the manufacture of bolts, nuts, rivets and spikes but in addition there are other unusual and difficult sections rolled which are of particular value for Railway Permanent Way and in the manufacture of locomotive, carriage and wagon springs. The latter are made from steel having a carbon content of between ·50% and 1·20% and both oil hardening and water hardening qualities are rolled. The sections for laminated springs are rolled with a concavity while those used in the manufacture of helical springs are tapered. Other wide and thin flats are also rolled for the production of volute springs. The bars for the manufacture of springs are despatched to the various Railway Workshops and particularly to a well known local firm where the actual springs are formed.

Some of the other special sections rolled are subsequently fabricated into various spring steel track fastenings such as loose jaws for steel sleepers, keys for double and bull-headed rails and for rail anchors. Other mild steel sections are rolled for the manufacture of taper keys tiebars, cotters gibs and other fittings required for use on the Indian Railway track.

Spring steel fastenings for the permanent way require heat-treatment and this is undertaken on a large scale in this country.

At the works visited, there is another department where steel is used in large quantities. This is the steel sleeper plant which has a capacity of 60,000 tons of finished sleepers per annum, but, owing to the shortage of steel it has not been possible to keep the plant in full operation for the past few years. It is hoped, however, that when steel becomes more readily available, the Indian Railways will continue their policy of using large numbers of steel sleepers owing to the longer life obtained as compared with wooden sleepers.

As will be seen, most of the articles produced are required for use on the Indian Railways and in addition to the various fastenings mentioned, India's requirements of points and crossings and signal fittings are also produced indigenously the rails used in the manufacture of these points and crossings being supplied by the Indian Steel Works.

DEFEATING THE SABOTEUR

The recent rail disasters, tragic in themselves have put an obligation on the manufacturers of

Railway Track fastenings. The average passenger as he is drawn to his destination has little conception of the thought that has been put into his safety and that of all other passengers by those who have, over a number of years, specialized in track design. With a very few exceptions, practically all track fastenings are manufactured from different grades of steel and the specification of steel used can, in itself, go a long way towards ensuring the safety of the travelling public. Many steel devices have been invented but it is safe to say that there is in India today no fastening proof against the saboteur. The extraction of vital fastenings, e. g., dogspikes, fishplates fishbolts etc. can be made more difficult but cannot be prevented.

Recent researches have produced various articles for anchoring the track and typical of these is the Macbet spike anchor, which, being made from spring steel, exerts a very heavy pressure when driven on to the rail flange. These spike anchors are extremely difficult to remove as they require a special extractor tool which is a fairly heavy implement and generally beyond the reach of the saboteur who, even if he obtained one, would have very great difficulty in utilizing it in the time at his disposal. These spike anchors are under trial by the Indian Railways from which good reports have been received despite the fact that the first complaint was the difficulty met with in removing them!

The spike anchor or the dog-spike does not, however, take care of the rail joint—the weak spot of the railway track. Here again steel is used in a special process known as "Thermit." This process joins together by means of fusion welding, long lengths of rails and thus reduces the number of joints and lessens the saboteur's chances of success. The process has not been widely used in India yet but considerable interest is being shown by all Permanent Way Engineers and the use of it is likely to be considerably extended.

SCOPE FOR FUTURE

The manufacture of the articles described above are, as previously stated, generally referred to as being engaged in "secondary industries" and while such industries have been in operation in Western countries for many years, they have not yet progressed very far in India. India is, however, rapidly becoming industrialized and the use of steel and steel manufactured articles is steadily on the increase.

Plans have been prepared for increased production of steel in this country and when sufficient steel becomes available the development and increase in these secondary industries is a natural consequence. Many steel articles now being imported should then be made in this country and it is felt that considerable scope will exist for those with vision and initiative, to engage in the production of articles manufactured by secondary industries.

We are thankful to "Statesman" of Calcutta for their so kind permission to reproduce the above article which appeared in their Supplement entitled "The Indian Iron & Steel Industry."

Wheels and Springs

AN important proportion of the total steel production of the United Steel Companies Ltd., of Sheffield, England, consists of Railway Materials. These include wheels, tyres, axles, springs, boiler and frame plates and miscellaneous forgings, for the *C. M. E.*; and rails, fishplates and steel sleepers for the *Civil Engineer*. The manufacturing equipment is kept constantly up-to-date. Two of the most modern installations are the new wheel mill and the mechanized spring shop at the works of Steel Peech and Tozer, a branch of the United Steel Companies. Since the steel is made at the same works, it is possible to maintain a uniform control over both steel quality and manufacturing technique thus ensuring a first class product.

SOLID WHEELS AND DISC CENTRES

The new Wheel Mill is laid out on the flow principle and is capable of producing 35 wheels per hour. A wide variety of wheels and disc centres, varying in diameter from 18 inches to 4 feet are manufactured.

Steel ingots are delivered to the wheel mill from the melting shop; they are closely inspected for surface defects and then divided into blocks of the weight required to form one wheel. Each block is marked and retains its identity throughout the whole sequence of operations. It is thus possible to trace the cast number and manufacturing history of each wheel.

The blocks are charged into a continuous gas-fired counter-flow furnace through which they travel on bogies; the speed of passage and all temperatures are controlled to ensure that the blocks are thoroughly heated to rolling temperature before reaching the discharging end.

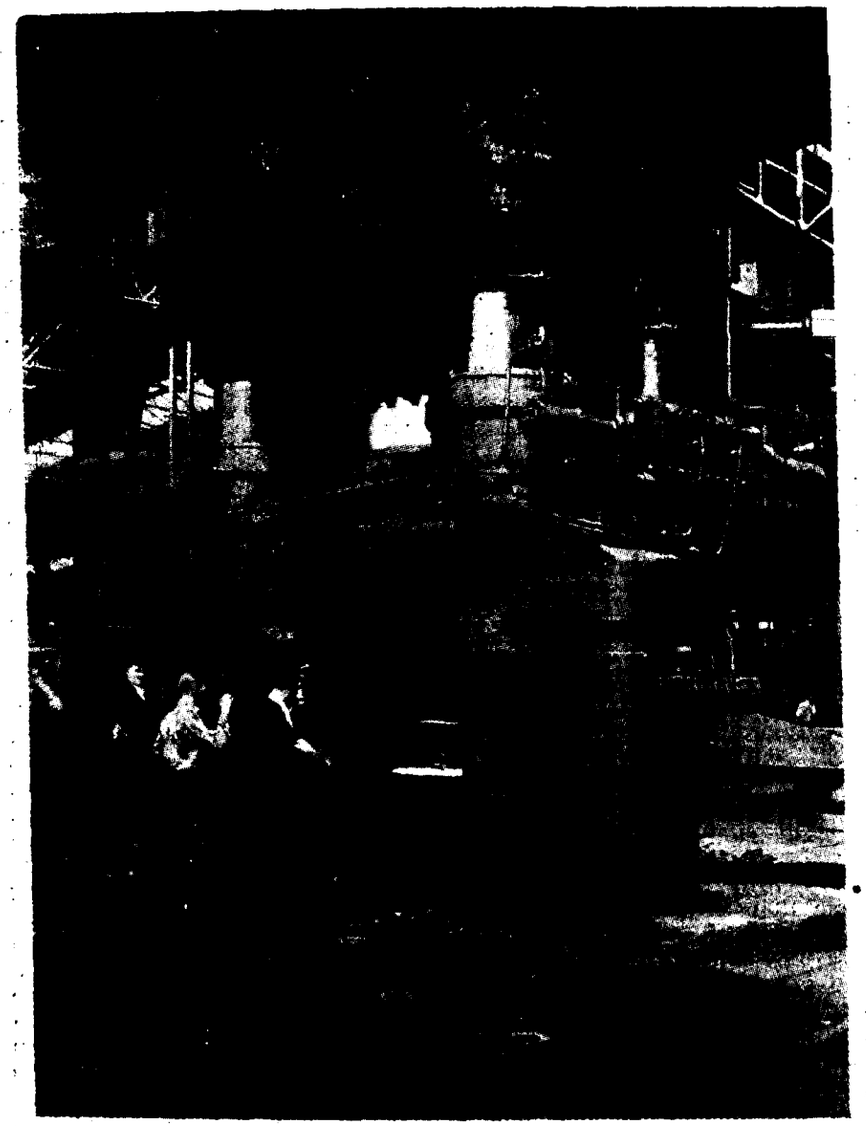
The heated block is removed from the furnace by means of a mechanical manipulator and inserted in a special de-scaling machine, which removes scale from the top and bottom of the block. It is then transferred to a 6000-ton forging press, where a series of operations convert it into a wheel blank. This has the characteristic shape of a wheel but the diameter is smaller and the web much thicker than that of the finished article.

On completion of forging, the wheel blank is charged, by means of a second manipulator, into a reheating furnace, where it is given a wash-heat to bring it to the required temperature for final rolling.

The finishing mill is of modern design and of the vertical type. The wheel blank is supported by a mandrel (A) whose ends rest in slides. Two web rolls, (B) driven by variable speed D. C. motors, are the only rolls driven. They are actuated by oil pressure and swing in a horizontal plane; when thrust inwards they exert equal pressure on the two sides of the wheel blank, which consequently begins to rotate in a vertical plane. The two edging rolls and the back roll (D) then move up and the five rolls combine to form the wheel. For the final operation the wheel is transferred by a third manipulator to a 1,500 ton dishing press; here the boss is forced into the correct horizontal plane relative to the head. The wheels are then ready for inspection and gauging, after which they are heat treated, tested, machined and despatched.

SPRINGS

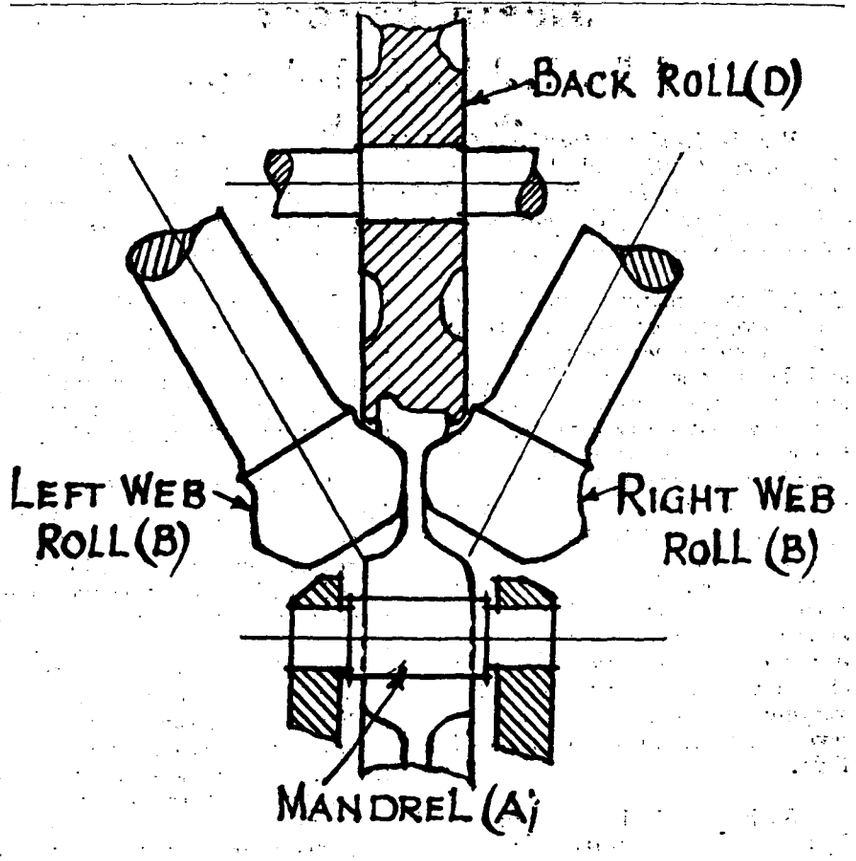
The mechanized spring shop is designed on the line production



principle and has a very high manufacturing capacity. Springs can be made from either carbon or alloy steels and they can be supplied in either water or oil hardening qualities.

The steel is rolled in the company's own mills, great emphasis being placed on the necessity for accuracy. A small variation in plate thickness will have a considerable effect on the deflection of a spring and where ribs and grooves are rolled it is essential that they should be central. The steel is delivered to the spring shop in 14 ft. to 16 ft. lengths.

The first series of operations consist in shearing the plates to length and then hot punching and spearing then in accordance



with the drawing. Furnaces and machines are grouped so that these operations can be carried out with a minimum of handling.

The plates are then charged into a continuous gas-fired hardening furnace in the correct sequence for assembly, being pushed through the furnace by a ram controlled from the delivery end; the furnace temperature is automatically controlled and is normally about 950°C at the delivery end.

On removal from the furnace each plate is placed in a special hydraulic press and bent to shape, it is then dropped into a water or oil bath, according to specification. An endless conveyor belt lifts the quenched plates from the bottom of the bath and they are then transferred to another conveyor belt, which passes through a carefully controlled tempering furnace. The speed of the belt and the temperature of the furnace are adjusted to ensure thorough tempering.

The plates next pass to the assembly section where they are checked to ensure that each fits correctly, against the plate immediately above in the spring. Any rectification that may be necessary is carried out and the plates are then assembled and a temporary buckle is fitted. The spring is checked on the oil-electric scragging machine, after which each plate is coated with linseed oil to prevent corrosion.

The final operation is the fitting of the buckle, the buckle is

(Continued on next page bottom)

normally heated prior to fitting; it is then located centrally on the spring and the complete assembly is placed in a specially designed press. Simultaneous vertical and horizontal pressure is applied to the buckle thereby ensuring a close fit.

On completion all springs are carefully examined and a proportion are checked for load against deflection, they are then painted and are ready for despath.

The production of the highest quality equipment for the Railways of the world calls for modern plant operated by skilled craftsmen, and to these assets Steel, Peech and Tozer can add the benefits of scientific research and the resources of many years' experience in the manufacture of Tyres, Wheels, Axles and Springs.

(By courtesy of M/S. Steel Peech and Tozer Ltd. a branch of the United Steel Companies Ltd., Sheffield, England).

Strain Gauges

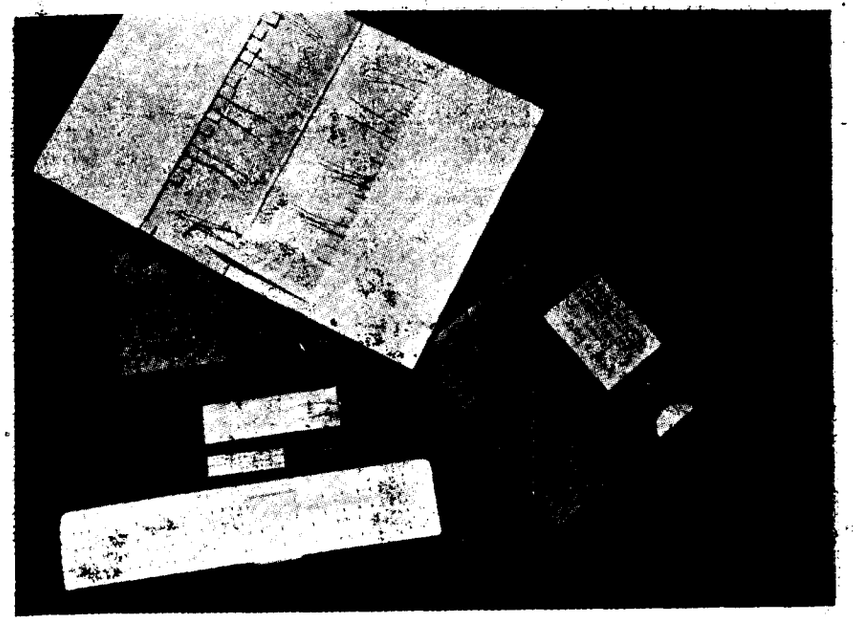
A New Tool for the Technician

For the ideal construction of a bridge, crane, aeroplane or a propeller shaft, a construction which of course should show no weak points but which at the same time is nowhere excessively strong, the engineer must know not only the properties of the material to be used but also the distribution of the strains and stresses occurring under different conditions of load.

FOR very many years already everything possible has been done to measure the tensile and bending stresses and torque arising in the material of which various work-pieces are made. In the case of a construction of any complicated form it is impossible to determine these stresses simply by calculation and they have to be measured either after erection or from a model. Hitherto this has been done by reproducing, on an enlarged scale, the variation in the distance between two suitably chosen points taking place under varying load, either by means of levers or with the aid of rays of light.

Such a method of measuring by means of mechanical and optical "extensometers" fails to answer the purpose, however, where the measuring points in a construction are difficult to reach. Neither is it suitable when, as is the case at practically all points of an aeroplane, strong vibrations occur in addition to the usual static load. Particularly in such cases as these strain gauges offer the solution.

A strain gauge is in essence just a wire, which, like so many materials, when its length is increased owing to a tensile force or reduced by a compressive force, undergoes a change in resistance and thus in its electrical conductivity. This change in the resistance, which was described by Lord Kelvin in 1856, can be easily and accurately measured by electrical means. Furthermore, by producing images of these variations in resistance on the screen of a cathode-ray oscillograph it is possible to measure rapid fluctuations in the load, thus also vibrations. The enormous development that electronic methods have undergone



Two pouches in which Philips strain gauges are sold and underneath two unpacked gauges; 1—the GM 4472, 2—the GM 4473

in recent years are thus employed to advantage for the measuring of non-electrical quantities like elongation, bending stress, torque, etc.

The wire used for the Philips strain gauges is of constantan (an alloy of 55% copper and 45% nickel) and it is glued in zig-zag fashion on to a strip of paper. The paper and the glue have to be so "stiff" as to ensure that the distortions taking place in the workpiece on to which the gauge is glued are fully transmitted to the resistance wire.

Of the two types produced by Philips the larger gauges are 5.5 cm. long and about 1 cm. wide, while the smaller ones are 3 cm. long and thus can be applied in places not so readily accessible for the larger ones.

When measurements are being taken it has to be borne in mind that changes in the resistance of the gauge may also arise through variations in temperature and humidity. Moisture for instance, affects the insulation resistance between the strain gauge and the work-piece to which it is applied, and consequently also the resistance measured. Moreover, moisture causes local swelling of the glue and the paper fibres, thus undesired distortions which in turn lead to a change in the resistance. For these reasons the strain gauge is covered with a thin layer of wax or with a sheet of rubber having inside it some moisture-absorbing material (e. g. silica gel), thus shutting out all air and moisture.

As is known, as the temperature varies so also the resistance of a conductor changes, and this is likewise the case with the strain gauge, though owing to the wire being of constantan this change is very small. Furthermore, as the temperature rises so the material of the workpiece expands, the resultant changes in the stresses not being due to any mechanical

Four strain gauges glued on to an upright of the overhead power line of the Electric Railway for measuring the change in static load and the vibrations occurring when the conductor breaks.

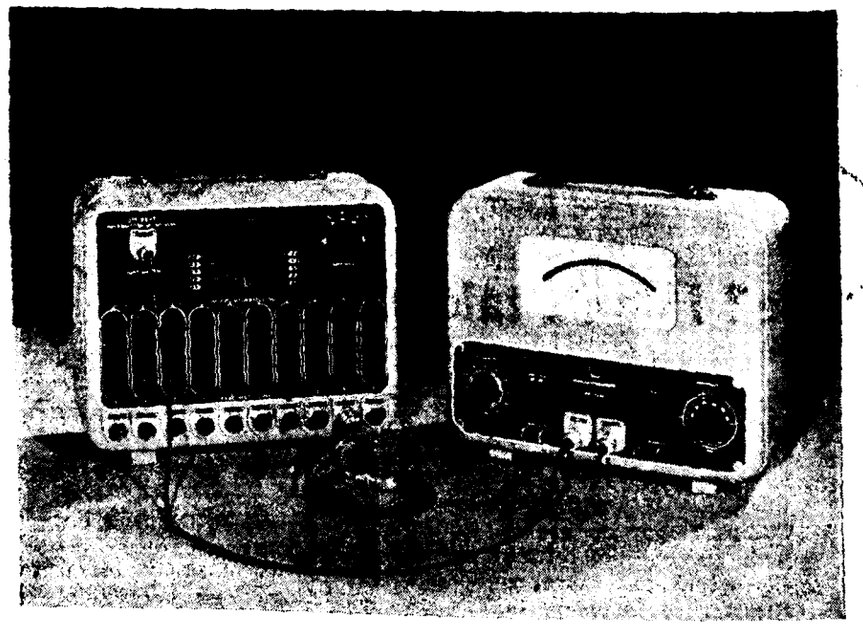
load acting upon the work-piece. In order to avoid the small errors likely to arise from this cause a compensating gauge (dummy gauge) is taken up in the Wheatstone bridge forming part of the measuring apparatus. This dummy gauge is applied close to the active one, on precisely the same material but at a point where it is not subject to mechanical load. The two gauges undergo exactly the same variations in temperature, so that the changes in resistance due to that cause are equal in both and cancel out in the bridge circuit, and only the resistance variation due to the load upon the work-piece is measured.

The calibrating factor of the strain gauges, that is to say the ratio of the relative resistance variation to the relative change in length, which is indicated for each individual gauge, enables the engineer to deduce the difference in stress in the work-piece from the variation measured in the resistance. Taking into account the fact that the calibrating factor need not be exactly the same for gauges produced in different batches, the measuring apparatus is provided with a correcting knob, which has to be previously set in the position corresponding to the calibrating factor of the gauge used.

Before the strain gauges are glued on, the material at the points selected has to be thoroughly cleaned, first with emery paper and then, for instance, with acetone. A special sort of glue has to be used, which is supplied by Philips in tubes.

POSSIBILITIES OF APPLICATION

Recently an opportunity presented itself to take a number of measurements on the standards carrying the overhead power lines of the electric railway near Eindhoven (Holland), with the purpose



Right: Measuring bridge for measuring static and dynamic loads.
Left: Switch for connecting the measuring bridge in rapid succession to any set of 10 pairs of strain gauges.

of determining, among others, the stresses arising when one of the conductors suddenly breaks. On this occasion the use of srtain gauges proved to be very valuable.

A different application is that where the strain gauges are glued on to the side of a ship about to be launched, in order to measure the great complexity of strains and stresses arising in the hull of the ship as it is launched into the water. The distribution of strain can be deduced from the changes in resistance taking place in a set of three guages glued on to the hull close together at an angle of 120°.

Apart from such direct applications as these, the strain gauges can also be used for measuring pressure and force. When pressure is transmitted to a diaphragm on to which a strain gauge has been glued this causes the diaphragm to bend and thus brings about a change in the resistance of the strain gauge. In this way by using special pressure boxes, the weight of an aeroplane can be very quickly determined; without such means a very large weigh-bridge would be needed. They can also be employed for safeguarding costly constructions, as for instance a crane, against overloading. When the maximum permissible load is reached this causes an elongation of the material which brings about a change in the resistance of the strain gauge applied at the critical points, this phenomenon being utilized to set an alarm going or to switch off the power supply of electro motors via relay apparatus.

The examples given here are of course only a few taken at random from a very wide variety of applications, for the number of possibilities is enormous. As an instance, special strain guages are being used for measuring and recording the beat of the heart and respiration by means of oscillographs.

Electric Traction

By Sri T. S. Rao, Chief Electrical Engineer, M. S. M. Railway

THE reason for the relatively slow progress in Railway Electrification is that operating savings do not produce sufficient quick returns on the capital investment unless a high traffic density either already exists or is certain to accompany electrification. This hitherto unsolved problem has been a challenge to the skill and ingenuity of the railway engineer, the power engineer and the manufacturer of electric traction equipment. A concerted co-operative effort of these is likely to solve the problem and fortunately a solution appears to be in sight with the A. C., H. T., single phase 50 cycles system.

I visited Hungary and Germany just before the war and made a study of the 50 cycle traction systems there. I returned convinced that the maximum economic advantage of using Central Station Power is obtained only if the contact line is operated at the industrial voltage and frequency, so that the E. H. T. voltage is transformed only once before supplying to the traction motor.

The service results in Hungary have shown that the corelated operation of electric traction with industrial power supply exerts a very favourable influence on the load conditions of the whole power transmission system. The power supply system could then be so planned as to involve the minimum total capital expeniture and minimum of maintenance, so that the combined costs of power supply for the Railway and general purposes should be a minimum.

Mr. T. S. Rao.

The Power Engineer may, therefore, find eventually, a steadily expanding field for power utilisation in Railway Electrification, particularly as the additional transmission system and sub-stations provided for electric traction could be used simultaneously for the general supply, enabling development of rural electrification *en route* at economical cost which would benefit both the Railways and other users of electricity.

A decision to electrify often hinges on the cost of power. A study of some of the electrification projects which have so far been worked out in India indicates that Railway Electrification cannot be

justified above a maximum rate of a quarter to one third of an anna per unit. The standardisation of a low tarriff for energy applicable throughout India or at least on a regional basis would assist in the early development of electric traction.

SYSTEM OF SUPPLY

The best system of supply for electric traction is a highly controversial subject. The tendency has been to adopt for main line work either single phase high voltage A. C. of not less than 11,000 volts and at 25 or 16⅔ cycles or 3,000 volts D. C. Economical considerations require that as high a contact line voltage as possible is selected, so that the sub-station spacing is as great as possible to provide enough capacity for distribution net work.

Railway Engineers are too prone to wait for perfection before standards are adopted. There is a great need for standardization of both the systems of supply and the types of locomotives. It would be desirable to standardise on one or two types of Locos only which could be used for mail, express and heavy goods services. In Hungary, a special type of locomotive has been designed which could be used for all classes of services. This would result in tremendous economic advantage of mass production.

The experiments on the 35 mile route of heavily graded line of Hollental Railway with four locomotives supplied at 20,000 volts single phase 50 cycles have demonstrated that electric traction system designed for 50 cycles industrial supply is technically feasible. All the four locos were similar in mechanical construction but two locos had mercury arc rectifiers to supply standard series motors, while the other two had motors designed to operate on 50 cycles supply.

In Russia, in order to decide the most suitable system for long distance main line electrification a less important line running into Moscow was equipped with an exprimental line for 20,000 volts 50 cycles single phase system to collect experimental data on

(a) Single phase 50 cycle motors,

(b) The Kando System,

(c) The Punga Schon System,

(d) The Westing House Split Phase System,

and *(e)* a locomotive designed to work with 20,000 volts D. C. on the contact work and equipped with inverted rectifiers supplying 3 phase electric motors.

The great advantage of the H. T. 50 cycles system is that it enables the distance between two points of supply to be increased considerably. This very often makes it possible to avoid the construction of a special high voltage line and to adopt a much lighter catenary, which, with the obvious simplification of the sub-stations enables a considerable reduction in the fixed equipment of the electrified line to be effected.

In the case of main lines, where only a few trains are run per day in each direction, H. T. A. C. system allow sub-stations and feeders being provided over a section of line only at widely spaced points of 40 to 60 miles. With a high frequency of trains the spacing will have to be reduced, as the voltage drop at any one time may be below permissible limit. Further a failure of one section puts a long stretch of the route out of action.

Special precautions must be taken to avoid unbalance between phases in the high voltage system, or, more accurately, to reduce this unbalance to an acceptable value, having regard to the total power of the system. Care must also be taken to protect telephone lines near the Railway by cabling the circuits. A compensating advantage, however, is that the corrosion phenomena caused by the D. C. System are avoided.

The fundamental problem to be solved prior to a general introduction of this system—which combines the advantages of the non-standard single phase and D.C. systems by avoiding the necessity for special power supplies, and at the same time reduces the cost of fixed equipment—is that of the traction motor. The technical progress made in the commutation of single phase commutator motors enables the simplest solution to be contemplated, namely that of the line-fed motor operating at 50 cycles.

Although the 50 cycle single phase series motors have been built for some experimental purpose, much work would still be required to perfect it and it would be necessary to carry out extensive trails under actual working conditions for several years before standardisation. The immediate solution would, therefore, appear to be to equip the locomotives with mercury arc rectifiers to supply standard series motors or to provide motor generator set rotary converter or for converting 50 cycle A. C. to 3,000 volts D. C. A further experimental development in U. S. A. is a design of a static frequency changer of about 5,000 K. V. A. which can be installed in the locomotive.

For the suburban area, where fast and frequent trains are necessary, there seems at present to be no alternative than to adopt 3,000 volts D. C. system as the design of robust A. C. commutator motors providing a high degree of acceleration and compact for installation in motor coaches has not yet been perfected. Besides, the provision of H. T., A. C., contact lines in busy suburban areas will also present considerable practical difficulties to ensure reliability and safety.

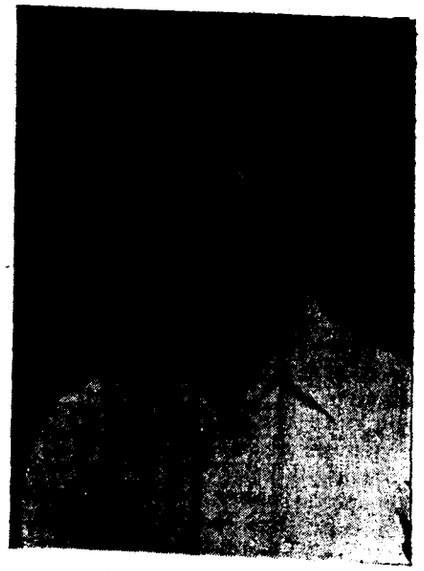
In a Memorandum on Railway Electrification which I had submitted to the Power Engineers' Conference in 1944, I had suggested that a high level committee should be appointed for making recommendations for the standardisation of the systems of supply and equipment for main line and suburban electrification. I remember that when a reference was made to the late Mr. Lydall, he expressed the opinion that in a vast country like India there was no reason why more than one system should not be adopted, so as to meet the particular needs of the various sections concerned. This applies with equal force to the Howrah-Moghalsarai Section. If it is proposed to proceed with this electrification project within the near future, it is suggested that 3,000 volt D. C. system may be adopted for the suburban section and, if necessary, for the main line also up to Burdwan, a distance of approximately 50 miles from Howrah. Beyond this distance it is desirable to adopt 19,000/22,000 volts A. C. 50 cycle system, as this would appear to indicate great economic possibilities.

Prestressing

By Sri S. Neelakantan, B. E.

Supervisor, B. B. & C. I. Railway

THE advent of Reinforced Concrete some hundred years back was hailed with great enthusiasm. Since then there have been many developments such as precast construction, shell construction, prestressed concrete and the like. But the most outstanding of these is prestressed concrete. It was thought that this would displace steel structures to a large extent. In fact some of the modern bridges are of prestressed concrete. But steel, in spite of its cost, held its own and the recent development of prestressed steel has shown a way towads cheaper steel structures. I propose to describe these two types of construction, namely prestressed concrete and steel, in the succeeding paragraphs.



Mr. S. Neelakantan

Prestressing is applying a preliminary stress to a member before being subjecting it to loading. The nature of this initial stress will be of opposite kind to that which will be developed when the member is loaded. The prestress will reduce to a considerable extent the loading stresses.

Prestressed concrete has been much heard of recently. Abroad many prestressed concrete structures have sprung up. The main reason given for prestressing is that concrete is weak in tension. Other advantages which follow prestressing, besides cancelling the tensile stresses produced by the load, are that it allows the use of higher working stresses in the concrete; it does away with difficulties in relation to resistance to shear; it permits lighter constructions, needing only half of the concrete and one sixth of the steel as compared to ordinary re-inforced concrete while the high tensile steel used costs only three times more per unit weight than ordinary bars. The chief characteristic of prestressed concrete is that even if cracks develop due to overloading they close on removal of load, only the load should not have caused stress in the steel beyond the yield point.

In theory, all that is required is to stretch high tensile steel wires at the bottom of a beam, for instance, and allow them to react on the surrounding concrete after the latter has hardened. The concrete, as a result, is subjected to compression. Since this compressive force does not act at the Neutral axis but a few inches below, the force is eccentric and tension is induced in part of the section. By controlling the eccentricity and the prestress applied, it is possible to induce compression throughout the section or tension in part of the section.

Let me illustrate this with an example of a beam reinforced with high tensile wires subject to prestressing. Let the beam have an effective sectional area. Aec. square inches with the wires '*e*' inches below the Neutral axis. When the steel fibres are stretched by a force 'F', the compressive force in the concrete is 'F'.

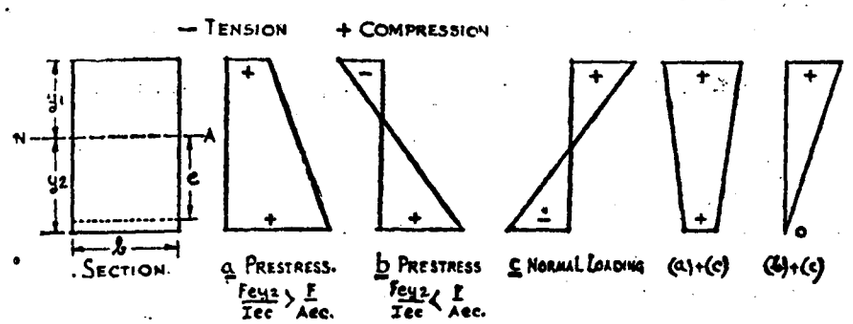
The extreme fibre stress at the bottom of a prestressed beam prior to loading $= \frac{F}{Aec} + \frac{F\ e\ y_1}{Iec.}$ .....1 } *Iec* = effective moment of inertia

and the fibre stress at the top $= \frac{F}{Aec} - \frac{Fey_2}{Iec}$ 2

If $\frac{F\ e\ y_2}{Iec}$ is greater than $\frac{F}{Aec}$, then the fibre stress at top will be tensile.

If now the beam is placed on two supports and loaded, a compressive stress $\frac{My_1}{Iec}$ is produced at top and a tensile stress $\frac{My_2}{Iec}$ is produced at the bottom. The prestress of compression at the bottom will cancel the tensile stress so that the concrete is in compression throughout enabling the whole are of concrete to be used.

What I have stated above is made clear by the following figures.



Finally before proceeding to prestressed steel, I will outline the common methods adopted in prestressing. One method is to stretch the wires before the concrete has set. When the concrete is set, the bond between the concrete and steel serves to compress the concrete when the wires are released. The other method is to coat the steel wires with grease to prevent bond between steel and concrete and then the wires are stretched when the concrete has set. The base plate takes up the reaction and compresses the concrete at the bottom. Space forbids my writing in detail about these methods.

Prestressed steel is a novel but quite a reasonable idea. At first one is apt to say, why should there be prestressed steel, steel is strong in tension. Looking deeper, we can see the great economy in prestressing. Some of the advantages derived in prestressing concrete are obtained in prestressing steel. The working stress of the steel used may be as high as 140,000 p. s. i. compared to the normal working stress of 20,000 p. s. i. now used. Hence to resist a given force, with the high tensile steel used, only one seventh of the weight necessary with mild steel will be required; as on the other hand the high tensiles steel costs

only three times as much as mild steel. The conclusion is that by replacing mild steel by high tensile steel a saving of 86% in weight and 57% in cost is effected. However there is one snag in this apparently tremendous economy. When the section is reduced, the deformation is increased proportionately. So, there is no question of replacing the tensile members as it would be impossible to have a rigid connection with the members made up of wires. Hence, for practical purposes a modest economy of 50% in weight and 20% in cost can be effected. This does not affect the usual factor of safety nor does it unduly increase the deformations. Besides this there are other sources of economy.

1. Reduction in self-weight 2. The cable can be raised towards the supports and this produces a shearing force of the contrary sign to that given by the loads introduced. This allows the diagonals and verticals to be made of lighter section. 3. Prestressing the bottom member induces tensile stresses in the top member thus effecting an economy in the top member also.

This economy is most important in cases where the dead weight of the girder is considerable compared to the loads on the girder. This happens when the span is great and loads are light. A striking example is an Aeroplane hanger.

To illustrate the saving effected by prestressing without affecting much the factor of safety or increasing the deformation, a table is cited from the ' Structural Engineer ' November 1950.

tl = tensile stresses in mild steel of a prestressed member.

	tl = 10,000 lbs.	tl = 20,000 lbs.
1. Ratio of weights (prestressed to ordinary)	0.67	0.5
2. Ratio of cost	0.87	0.66
3. Factor of safety	2.00	1.50
4. Ratio of deformation	1.50	2.00

It can be seen now that for stresses as low as 10,000 lbs. the saving is significant.

The prestressing is done by a cable stretched and anchored suitably. The reaction of the tension in the cable produces compression in the prestressed member. This results in the reduction of tensile stress of the member produced by loading.

A method has been suggested for prestressing a girder utilising the slab of the roadway. The slab is cast in suite on the top of the girder while the girder is still supported by its formwork. The formwork is released only after the concrete has set. Alternatively, if the girder is continuous, when the concrete has set all the supports except the end ones are slightly lowered.

Though the principle is same in both prestressed steel and concrete, there are some fundamental differences between them. The stress in the cable in prestressed concrete varies only by 3 to 4% when additional load acts on the beam while this is not true of prestressed steel girder where the variations are 3 to 4 times higher.

This is due to the fact that the stresses involved are 20 times higher while the modulus of mild steel is only 5 to 6 times that of concrete. The loss of prestress caused by every two wires newly stretched each time is 2 to 3 times greater in concrete than in steel. This must be taken into account in practice. Lastly there is no question of loss of prestress through shrinkage or even of creep in mild steel as there is in concrete. With the modern wire there is practically no relaxation.

Prestressing is rapidly gaining popularity. Already prestressed concrete has found a place in modern structures. Prestressed steel, lately developed, is also bound to take a great part in economical constructions. Methods have been evolved for convenient anchorage and for suitably applying prestress. Tests have been conducted to prove the economy, without sacrificing safety, of prestressed structures. Very soon prestressing will be common knowledge as re-inforced concrete is to-day.

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Centre Lathe or Turret Lathe ?

WHEN considering the installation of machines of the lathe type one of the most important factors affecting the selection is the size of batches of work which have to be machined.

All machines of this type have been developed from primitive lathes which date back to the very earliest times. When the centre lathe, basically in principle as we know it to-day, became established, it was used as a general-purpose machine irrespective of the production required because there was no alternative. It was not until the end of the nineteenth century that Capstan and Turret lathes came into general use to meet the needs of the cycle and other industries in dealing with repetition work which with the expansion of industry and the need for greater production led to the introduction of the automatic chucking machine and automatic screw machine.

This trend of development is often responsible for the impression that a Capstan lathe or Turret lathe is suitable only for batch work and will not deal economically with parts made in small quantities which would normally be done only on a centre lathe.

There are many firms using centre lathes for work which could be dealt with more economically on Capstan and Turret lathes, developments in design and the versatility of modern tooling equipment having greatly increased the field for their application.

Capstan and Turret lathes with their multiple tools are primarily

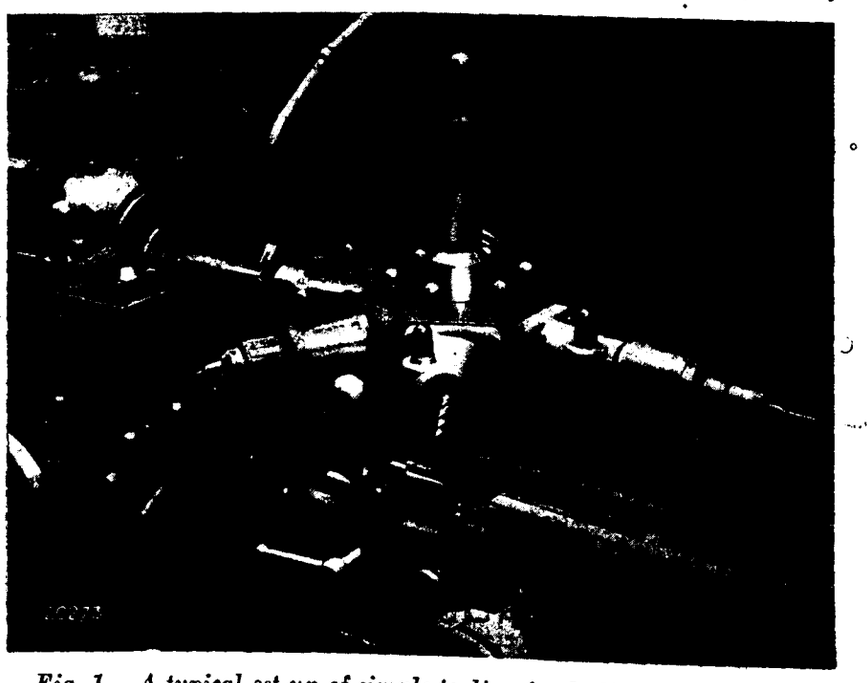


Fig. 1. A typical set-up of simple tooling for dealing efficiently with centre-lathe work on a Herbert No. 4 Senior Capstan Lathe.

for repetition work, but the exceptional ease of setting the standard tools available makes it possible to machine one or two articles at considerably less than centre lathe costs providing the operation is not too short.

Labour rates on Capstan and Turret lathes are usualy lower than those on centre lathes. A skilled operator is usually required for each centre lathe. When several Capstan lathes are used the labour involved is usually a youth or girl to operate each machine and a skilled tool-setter to do any setting up required.

In the works of Alfred Herbert Ltd., Coventry where some 2,000 machine tools are in operation, batches are comparatively small, but very few centre lathes are used and these are being gradually replaced by Capstan and Turret lathes.

In their tool-room 13 Capstan and Turret lathes are already installed.

It is of interest to note the following percentages of centre-lathe work on three batches, selected at random, of machines completed in their works. In a batch of 50 Herbert No. 4 Senior Capstan Lathes, only one-half of 1% of the work was machined on a centre lathe; in a batch of 24 Herbert No. 9B Combination Turret Lathes, only three-quarters of 1%; and in a batch of 12 Herbert No. 2 Hexagon Turret Lathes, only seven-eighths of 1%.

Apart from the work involving single operations or where special threads have to be cut, their well-equipped Capstan and Turret lathe department is capable of handling odd jobs—ones, twos and threes—economically with accuracy equal to or superior to that obtained on

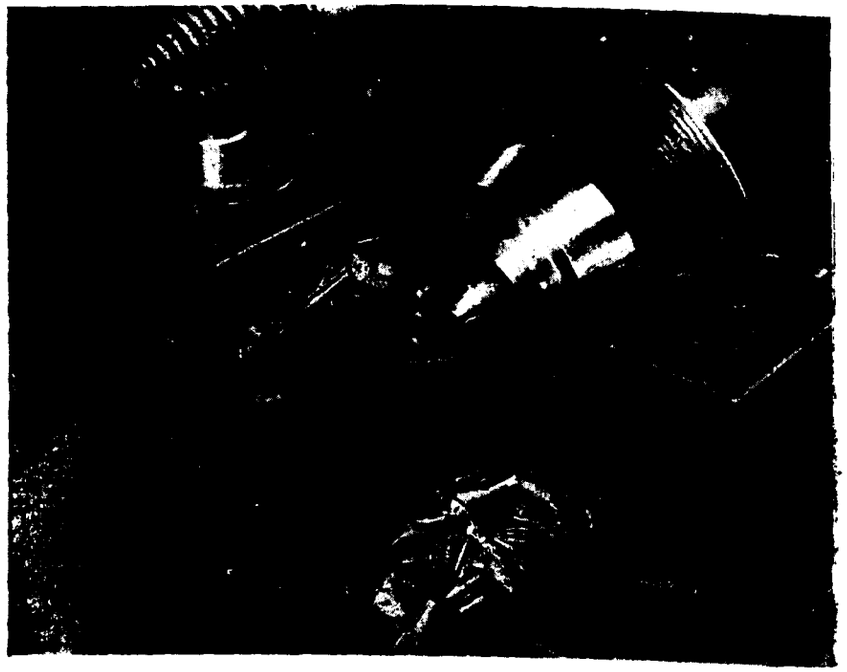


Fig. 2. Rough forming with a broad-nose form tool, the 20° angle on the milling cutter body shown in Fig. 3

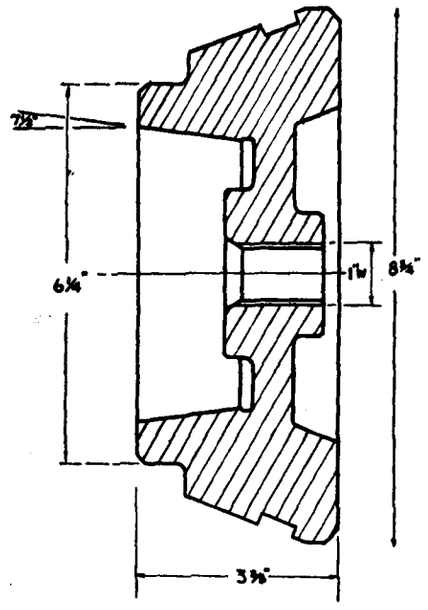


Fig. 3. Milling cutter body completely machined in the tool room on a Herbert No. 9B Combination Turret Lathe. A batch of three was required.

the centre lathe, and in a shorter floor-to-floor time.

The wide range of dieheads and taps now available for special and standard threads has increased further the scope of the Turret lathe by enabling work which has to be threaded, to be completed in less time and with considerable reductions in cost, than when the thread is cut by a single-point tool.

The automatic traversing Capstan or Turret slide is also a feature which provides for increased production. On centre lathes all traversing movements of tools held in the tailstock are hand-operated with considerable fatigue to the operator.

This is most apparent in drilling large diameter holes. A constant feed is difficult to maintain by hand and this is most important in drilling and particularly so in reaming and boring operations, to ensure good surface finish. It should also be borne in mind that in drilling on a centre lathe, particularly large holes, the torque is taken by a key which tends to wear and widen the keyway with resultant damage to the machine and impaired accuracy.

Tapping is another operation which can be done more easily on a Capstan or Turret lathe than on a centre lathe, the pilot wheel control enabling the thread to be followed more closely and uniformly than the handwheel control on a tailstock.

The compound slide on the centre lathe is primarily for short tapers and its limitations in external and internal taper operations are well-known particularly in comparison with the taper-turning attachment fitted to Herbert Capstan and Turret Lathes which provides for short and long tapers.

Odd jobs or batches up to six can be machined economically when rapid set-ups are used comprising tools that can be quickly set and adjusted to size.

On Turret lathes external operations are dealt with by tools on the cross slide and internal operations are done from the Turret. When turning from the cross slide and using a centre support in the Turret, the cross-slide dial can be used for diameter size.

The length of traversing operations from the Turret can also be controlled by a graduated scale and pointer, the pilot wheel is also provided with accurate indicators which ensure accurate duplication of length dimensions.

Machine stops need not be set; calipers, micrometers or gauges can be used.

Fig. 4. Machining a large collet on a Herbert No. 9B Combination Turret Lathe. Only one was required and it was completely machined, to the dimensions shown in Fig. 5 from a rough forging produced from a 7" diameter steel bar.

A running centre in the Turret virtually changes the Turret lathe into a centre lathe. In fact, in producing odd jobs on a Turret lathe the machine must be regarded as a centre lathe and the facilities of the cross-slide toolposts and Turret faces for accommodating several tools eliminate the necessity to change the tool for each operation, which is usually necessary on a centre lathe.

For example, internal operations often include drilling, reaming, recessing and threading. In a centre lathe for each individual operation the tool must be changed, with a considerable loss of time.

On a Turret lathe the tools can be mounted in sequence on the Turret faces, providing an uninterrupted operation from the time of starting the spindle to the removal of the work from the chuck.

The versatility of the modern Turret lathe with its wide reversible speed range so readily available, the ease of setting, the extreme rigidity and power available to enable full advantage to be taken of carbide tools, the large number of tools which can be accommodated, the ease of operational control and simplicity of machining and the many features for the reduction of idle time to the minimum, provides for the economical production of a variety of precision work by unskilled labour.

When a chargehand receives the work his first consideration should be to see that it is put on a machine which has been tooled for work of similar type and size so

that the minimum of alterations to the tooling equipment is involved.

This is particularly advantageous on odd jobs—to reduce setting to the minimum and to be able to revert quickly to any interrupted production work. This change-over can usually be accommodated between batches or at a time when the machine is not fully occupied.

A typical change-over is shown in Fig. 1, which shows a Herbert No. 4 Senior Capstan Lathe with Dial Change Headstock. Rapid speed changing is available for all operations which for the production of an odd job from the bar includes facing, rough and finish turning, recessing, centreing, drilling, tapping, threading with a Coventry Diehead and parting off. A running centre is used.

A rapid sequence of operations is possible with maximum efficiency in precision, production and labour.

Examples of odd jobs, normally accepted as centre lathe work, which are being produced on Turret lathes in the tool-room, of Alfred Herbert Ltd., Coventry are shown in Figs. 2 to 7.

These particular operations are typical of many and indicate the advantages of the Turret lathe over the centre lathe.

Fig. 2 shows a Herbert No. 9B Combination Turret Lathe machining a 9in. milling cutter body of which three are required.

The machine is used as a centre lathe for machining the internal and external surfaces as

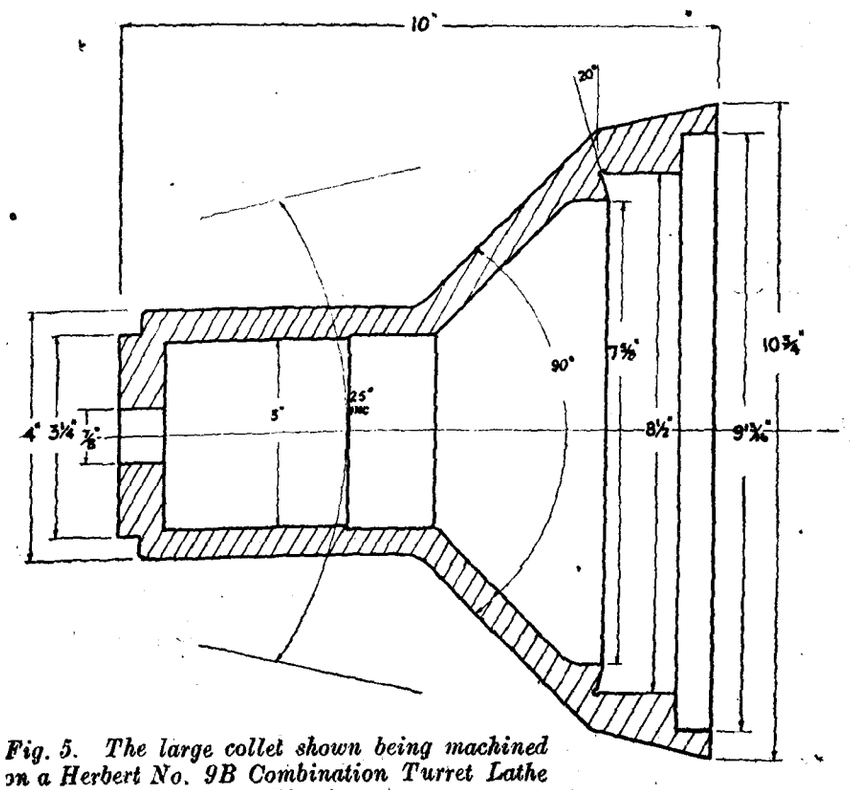


Fig. 5. The large collet shown being machined on a Herbert No. 9B Combination Turret Lathe in Fig. 4

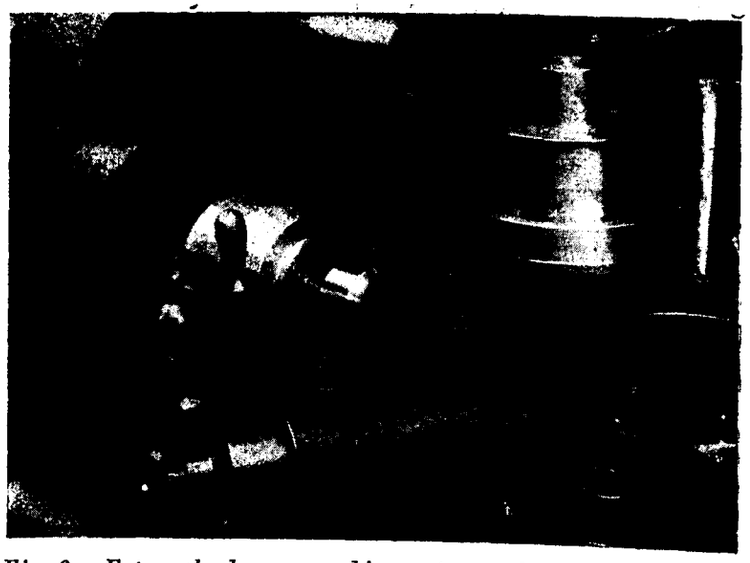


Fig. 6. Extremely heavy roughing cuts are being employed in forming an arbor, shown diagrammatically in Fig. 7, on a Herbert No. 7 Combination Turret Lathe.

shown by the drawing, Fig. 3. Made from a 9in. diameter blank previously cut off the bar, the 8¾in. diameter is turned, faced and chamfered and the recess in the face formed by a standard form tool.

The blank is then reversed and held on the 8¾in. diameter in soft jaws and faced to 3⅜in. long;

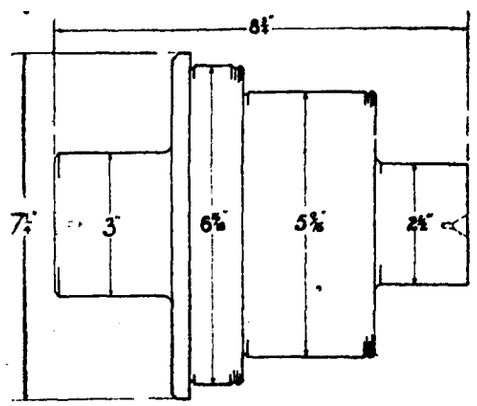


Fig. 7. A batch of three arbors similar in shape but varying in dimensions are economically produced on a Herbert No. 7 Combination Turret Lathe.

the 6¼ in. diameter is turned and chamfered from the front toolpost. A drill in the Turret part drills the recess which is trepanned and the 7½° taper is turned and under-cut. The 1 in. "Whitworth hole is then drilled and tapped, using a standard tapping drill and machine tap.

The taper-turning attachment fitted to the machine is used for the internal tapering operation.

The component is then supported by a live centre and the 20° angle on the outside diameter is turned and the groove recessed. The 20° angle is formed with a standard broad-nose form tool ground to a suitable angle and a heavy roughing cut is taken as shown in Fig. 2, and a finishing cut.

A similar operation on a Centre lathe would necessitate the use of a taper-turning attachment, taking several light cuts.

By producing three milling cutter bodies on the Turret lathe an estimated 25% saving in costs is

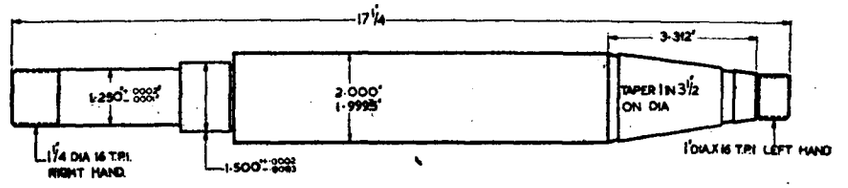


Fig. 8. A spindle machined from a Nitralloy steel bar on a Herbert No. 4 Senior Capstan Lathe with Preoptive Headstock in a floor-to-floor time of 60 minutes - a 50% saving over the time taken on a Centre Lathe. Batches of 6 or 12 only were required.

made in comparison with the production of the same work on a Centre lathe.

A further interesting example is the production of a single large collet using standard tooling equipment on a Herbert No. 9B Combination Turret Lathe.

The operation is shown in Fig. 4 and the sequence of operations on the component, shown in Fig. 5, is as follows:

This job is a rough forging made from a 7in. diameter steel bar.

The 10¾in. diameter is turned and faced and the 25° taper is formed. The internal form is then rough turned, using 5in. and 2⅞ in. diameter drill bits and bodies.

The component is then reversed and held in soft jaws on the 25° angle. The 4in. and 3½in. diameters are turned, the 45° angle is formed from the front tool-post and the ⅞in. diameter drilled and bored from the turret.

Reversing the component and holding the 4in. diameter in soft jaws the 3in. and 8½in. bores are reamed and the 20° inside angle formed.

The 7⅜in. diameter is turned and the 90° angle is formed.

All forming operations are performed from the cross slide using standard form tools.

The component is then carburised before the 9 1 3/16 in is turned.

Savings of 25% in labour cost are made compared with production on a Centre lathe.

Fig. 6 shows a Herbert No. 7 combination Turret Lathe machining an arbor similar in form to the arbor standing on the turret and diagrammatically shown in Fig. 7.

This is an exceptionally good example of a batch of three components produced on a Turret lathe. Considerable reductions in diameter are required and the heaviest cuts, using Ardoloy-tipped tools, are taken in the roughing operation, with a final finishing cut. On the centre lathe the number of cuts would be doubled.

The three arbors being produced are of similar shape varying only in dimensions. With the tools mounted in the front and rear toolposts rapid indexing of the front toolpost permits a quicker change-over from one tool to another and the laborious changing of tools necessary in the Centre lathe is eliminated.

The sequence of the operation is as follows:—

Hold 7½in. diameter blank sawn from the bar, centre end and support bar with revolving centre in the turret.

Rough turn $5\frac{9}{16}$ in. diameter, one cut of $\frac{7}{8}$in. depth.

Rough turn $2\frac{1}{2}$ in. diameter, two cuts of $\frac{3}{4}$ in. depth.

Rough turn $6\frac{1}{16}$ in. diameter, one cut of $\frac{3}{8}$in. depth.

Turn $7\frac{1}{4}$in. diameter.

These turning operations are performed with an Ardoloy-tipped tool in the rear toolpost.

Finish turn $6\frac{1}{16}$ in. and $5\frac{9}{16}$in. diameters, face ends, undercut and recess with tools in the front toolpost.

Reversing the work and holding on the $5\frac{9}{16}$in. diameter in soft jaws, centre end and face to length.

Rough and finish turn 3in. diameter, chamfer 3in. and $7\frac{1}{4}$in. diameters and recess and undercut on the $6\frac{1}{16}$in. diameter.

One of the engineers of Alfred Herbert Ltd., Coventry visited a firm in the Midlands to demonstrate the economies in time, labour and material to be effected by machining small quantities—one to twelve off—on the Herbert No. 4 Senior Capstan Lathe with Preoptive Headstock which had been recently installed.

Eleven different components (two are shown in Figs. 8 and 9) have been produced on this Machine and, using standard tooling, from 50 to 70% savings have been made in comparison with the production of the same work on Centre lathes.

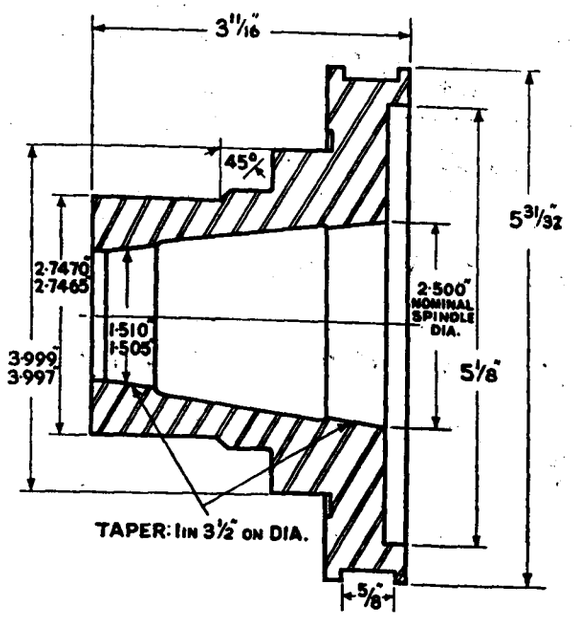


Fig. 9. An excellent example of the savings to be effected in producing small batches on a Capstan Lathe. Twelve of these mild steel grinding wheel flanges were produced in less than a third of the time taken on a Centre Lathe.

This has been made possible by the elimination of idle time for speed changing on the Preoptive Headstock, the use of Ardoloy with consequent high cutting speeds, the quick-acting square Turret and Chipstream tools.

One of the most outstanding examples of time-saving was the production of twelve grinding wheel flanges (see Fig. 9) on the No. 4 Senior.

Produced from blanks sawn from a 6in. diameter bar, standard Ardoloy-tipped tools were used throughout and twelve flanges were completely machined in 18 hours. This production time includes all setting and a 50% bonus allowance to the operator.

Previously 63 hours had been allowed for producing a similar number of flanges on a Centre lathe.

In machining the flange three operations were necessary to ensure parallelism between the two faces of the $5\frac{31}{32}$in. diameter, concentricity between these two faces and the 2·7470/2·7465in. and 3·999/3·997in. diameters to the accurately machined taper. A high degree of surface finish was obtained on all surfaces to eliminate subsequent grinding operations.

The first operation consisted of facing one end and drilling a 1·510/1·505 in. hole through the bar. This provided a machined face for accurate location when chucking for the second operation.

The second operation included turning and facing the $5\frac{31}{32}$in. diameter and cutting a $\frac{5}{8}$in. wide slot, boring the $5\frac{1}{8}$in. diameter and accurately forming the taper.

The taper was cut by a single point tool mounted in the front toolpost and actuated by the taper turning attachment fitted to the machine.

In the third operation, the flange was mounted on a taper mandrel gripped at one end by the chuck and supported by a centre in the turret. This ensured that the 2.7470/2.7465in. and 3.999/3.997 in. diameters and rear face of the $5\frac{31}{32}$in. diameters were machined concentric to the 1in. $3\frac{1}{2}$in. taper.

Seven changes of speed were made during the machining of each flange. Each speed was preselected whilst the tools were cutting and brought into use when required. The ease of speed changing always induces the operator to use the appropriate speed even for short operations. Speed changing on a centre lathe is comparatively troublesome and many operators do not therefore carry out machining operations at maximum efficiency.

The savings effected by the No. 4 Senior resulted in a decision to install a No. 2D Capstan Lathe and a No. 8 Preoptive Combination Turret Lathe to deal with the smaller and larger work respectively. The production from these three machines was such that 9 Centre Lathes were taken out of their works.

The examples given are typical of the results obtained by the use of modern time and labour-saving machines and equipment.

NOTICE

We have pleasure in appointing Mr. D. P. Mazumdar, 30/27, Radha Madhav Dutta Garden Lane, Beleghata, Calcutta as our Representative in Calcutta for canvassing advertisements to our Magazine with effect from 15th March, 1951.

Manager

Hindustan's Latest 407 Rail Coach

By G. Janakiram Shetty

The contributor of this article Sri G. Janakiram Shetty, President of the Railway Passengers' Association, Madras, describes about 407 Type Rail Coach manufactured by the Hindustan Aircraft Ltd., Bangalore. It may be mentioned that the former type 404 Rail Coach of which a hundred have been delivered to the Ministry of Railways is also manufactured by Hindustan Aircraft Ltd. The latest 407 model replaces the 404 Type Coach.–ED. S.R.M.

IT is a matter for gratification to know that the Government have contracted with the Hindustan Aircraft Factory, Bangalore for the building of improved Model, 407 Third Class Coach with anti-telescoping device. I had the privilege of seeing this new type coach at the Hindustan Aircraft Factory and I must say that the coach is well and neatly designed to meet the needs of the travelling public.

With a seating capacity of 76 passengers, the entire coach is divided into two big and two small compartments the latter being reserved for ladies. 20 Fans are provided for each coach, two fans for each double row of seats. There are also better arrangements for lavatory, with a wash basin attached. The anti-telescoping device referred to above consists of rolled steel structure built at the end of the coach on either side which in case of collision will absorb the shock instead of the coach, getting the impact first. Lavatory is also situated at each end of the coach, so that the injury to passengers at the time of collision may be avoided, the lavatories receiving the impact first. These arrangments are precautionary and is expected that they will combat successfully the influences of sabotage. In these days when Railway accidents are not uncommon the news of the construction of improved (Model 407) Third Class Coach will be received with satisfaction by the public.

Further amenities are also provided to the coach. Better lighting is provided inside the compartment, besides provision of electric fans. Provision of "embarkation lights" outside the trains also deserves mention, for when the train is stationary or is running at a low speed, the coaches are illuminated outside also, so that it may be of help to passengers especially at such stations as are not well lighted. Large space is allowed to each passenger, viz. 24" per passenger as against 19½" at present allowed. The coach itself is well ventilated by means of roof exhausts which maintain a constant flow of air when the train is in motion.

In the new coach there is an electrical equipment which generates power for its own needs. Thus every coach is self-contained. To sum up, the provision of fans, efficient roof exhausts, more space for passengers, better ventilation system, provision of separate electric equipment, and improved lay out of the coach are some of the features of improvement over the present Third Class Coach. I take it that it will take sometime before adequate number of these improved

Interior of the latest and newest III Class type rail coaches which are being built by Hindustan Aircraft Ltd., to serve India's biggest travelling public—the Third Class Traveller.

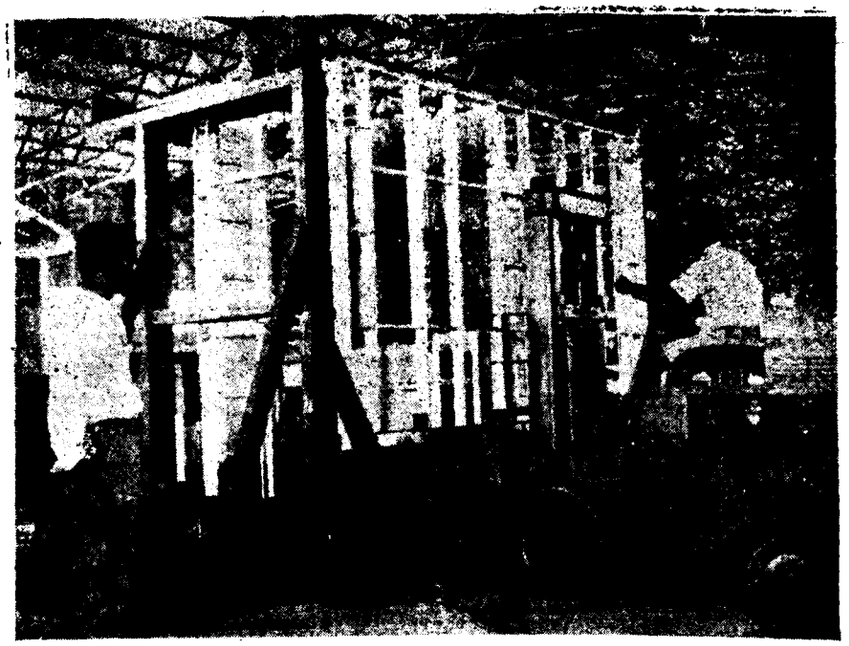
This Company, who has now built over 130 of these modern coaches—is building them with one uppermost thought.

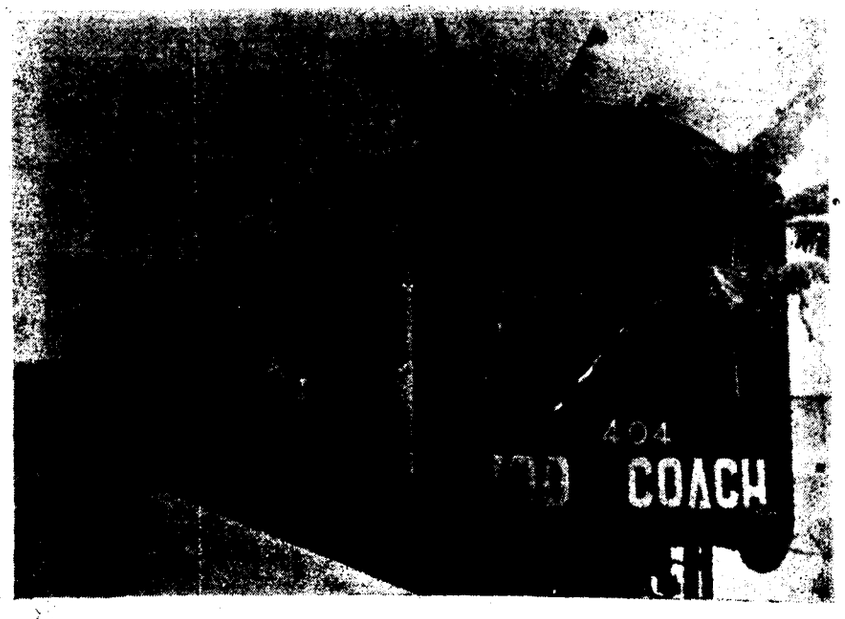
To give Third Class Passengers all possible comfort–with more space and room to move about–more fans–more lights, up-to-date washrooms, in short–maximum amenities.

They are now coming off Hindustan Aircraft's production line faster and faster to provide more of these comfortable rail coaches for India's Travelling Millions.

models are got ready to enable them to be put on all the Railways. The Government deserves to be congratulated on the improved model of Third Class Coaches which they are introducing in the Railways. I am confident that this will go a long way to mitigate the sufferings of Third Class Passengers and to meet the agitation on their behalf by Associations interested in the welfare of Passengers.

Whatever be the conveniences and amenities provided in the coaches, they cannot be availed of or enjoyed to the full benefit, unless and until the passengers should conform to the rules of administration and avoid carrying of too much luggage, so that congestion and overcrowding may be avoided. For such congestion and overcrowding will not only negative the amenities provided but also pre-





vent the ingress and exit of passengers thus making Railway Travel difficult and irksome. The Railway Associations have got a great part to play in this regard. In short a sense of social consciousness should be inculcated into the minds of the travelling public.

(Continued on next page bottom)

Recorded Multi-Lingual Railway Station Announcements

TO speed Customs and immigration formalities and generally assist the foreign visitor, recorded multi-lingual announcements have recently been introduced at Harwich, Parkeston Quay, Station of British Railways. Magnetic tape recording equipment supplied by The General Electric Co., Ltd., to the requirements of Mr. A. Moss, Signal and Telecommunications Engineer, Eastern Region, British Railways is used for this purpose and provision is made for all announcements to be given in English, Dutch, Danish and German.

During the preliminary investigations consideration was given to the alternative claims of both disc and magnetic tape recordings and after careful examination it was decided to adopt the latter. It was felt that the over-riding advantage of magnetic tape over disc recordings, particularly with the large numbers of playings required for station announcement work, was the fact that magnetic tape has a long life mechanically and does not deteriorate with continued replaying, and also affords easy recording on site of additional announcements not normally provided. The tape speed used is 7½ ins. per second giving an upper frequency response of approximately 8 kc/s. which it was considered was necessary to give clearly intelligible speech reproduction under the poor acoustic conditions met on Railway Stations.

The Hindustan Aircraft Co., Ltd., deserves to be congratulated on the various improvements effected to the new coach besides the most important anti-telescoping device and the public are really thankful to them for their efforts in this direction.

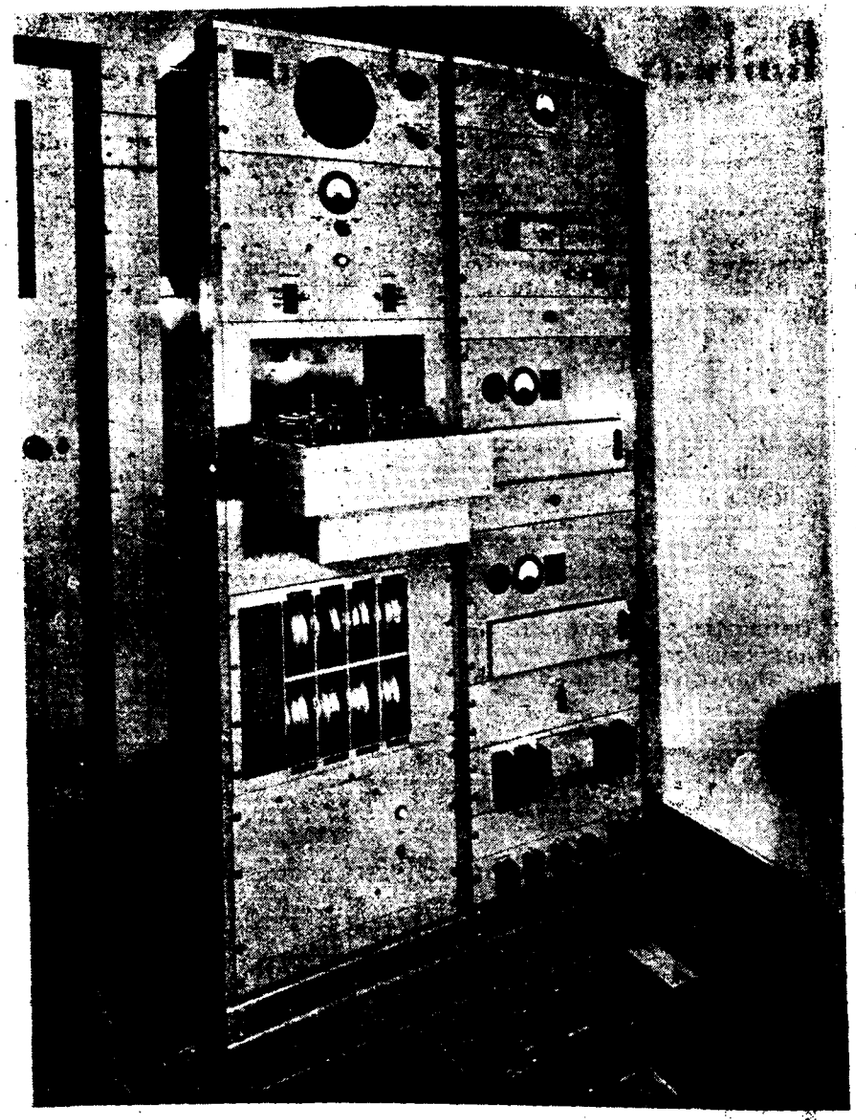


Fig. 1. G. E. C. sound equipment at Parkeston Quay Station, Eastern Region, British Railways. The tape recorder is the left hand rack of apparatus. Below the desk which carries the tape mechanism are the bins for the storage of spools recorded with the announcements needed for various beat and train services.

The right hand rack of apparatus is the amplifier rack of the normal sound equipment at the station.

Each announcement is given in English, Dutch, and German for the European Services and in English and Danish for the Scandinavian Services. Depending upon the information required to be given, certain of the tapes provide for a series of announcements, others only giving single announcements. In all cases however each

announcement is given in English followed by the foreign language, the full requirements being met by 18 spools of tape.

The tape in 80 yard lengths is wound on to standard 5 inch diameter 8 mm. cine-film spools. Each spool is clearly numbered on both sides and is provided with a suitable containing can also numbered on both sides and around the outer rim of the cover. As will be seen from the photograph, storage facilities have been provided immediately below the mechanism unit, twenty-four cans and spools being supplied, six blank spools being provided for local special recordings. Rapid identification of the spool required is given by reference to the label fixed alongside the storage compartment which details the tape number, languages in which the tape is recorded, together with a brief description of the announcement.

When this scheme was first considered, it was agreed that whilst fully automatic operation was most desirable, the prevailing economic position preculded the high expenditure necessary to produce this facility. A compromise was therefore adopted which, while minimising the operation required, still entailed the threading of the tapes by the operator. This enabled a standard type commercial mechanism to be adopted with only minor modifications to suit the particular site requirements.

Parkeston Quay Station was already equipped with a G. E. C. loudspeaker installation serving both the Main Boat Train Platform and the Quay, and the tape recording equipment has been mounted on a standard 6 ft. equipment rack and fixed adjacent to the existing apparatus.

From the photograph it will be seen that the complete apparatus takes up very little space and consists of the following panels mounted on two rack frames. The left hand frame contains the recording and reproducing equipment proper, the right hand rack frame containing the station announcing amplifiers and associated equipment. At the top of the left hand rack is fitted a monitor loudspeaker panel to enable the operator to listen independently to the recordings, or to the main amplifier during broadcasts on the station. The second panel contains the recording, erase and playback amplifiers together with the necessary control keys and valve test meter. The various volume and tone controls are of the pre-set-type with slotted spindles mounted under a cover. The third panel houses the main mechanism consisting of a flat motor plate upon which is mounted the two spindles carrying the 5 inch diameter spools, the main control switch, the erase, recording and reproducing heads together with the necessary guide pulley, automatic switching pillars and constant speed drive Capstan. Immediately below the mechanism is mounted the spool storage compartment, described above, and below this the main power unit providing both H. T. and L. T. supplies for the recording, erase and rproducing units. In the right hand rack frame are mounted the main amplifiers with their associated control and distribution panels.

Here it should de mentioned that the use of recorded multilingual announcements in no way supersedes the use of the normal system of announcements for which a ribbon type microphone and announcers' control cabinet, containing volume level meter, loudspeaker group selection keys and indicator lamps, is provided in an adjoining soundproof room.

METHOD OF OPERATION—PLAYBACK

As the arrival of a boat train or ship is known well in advance

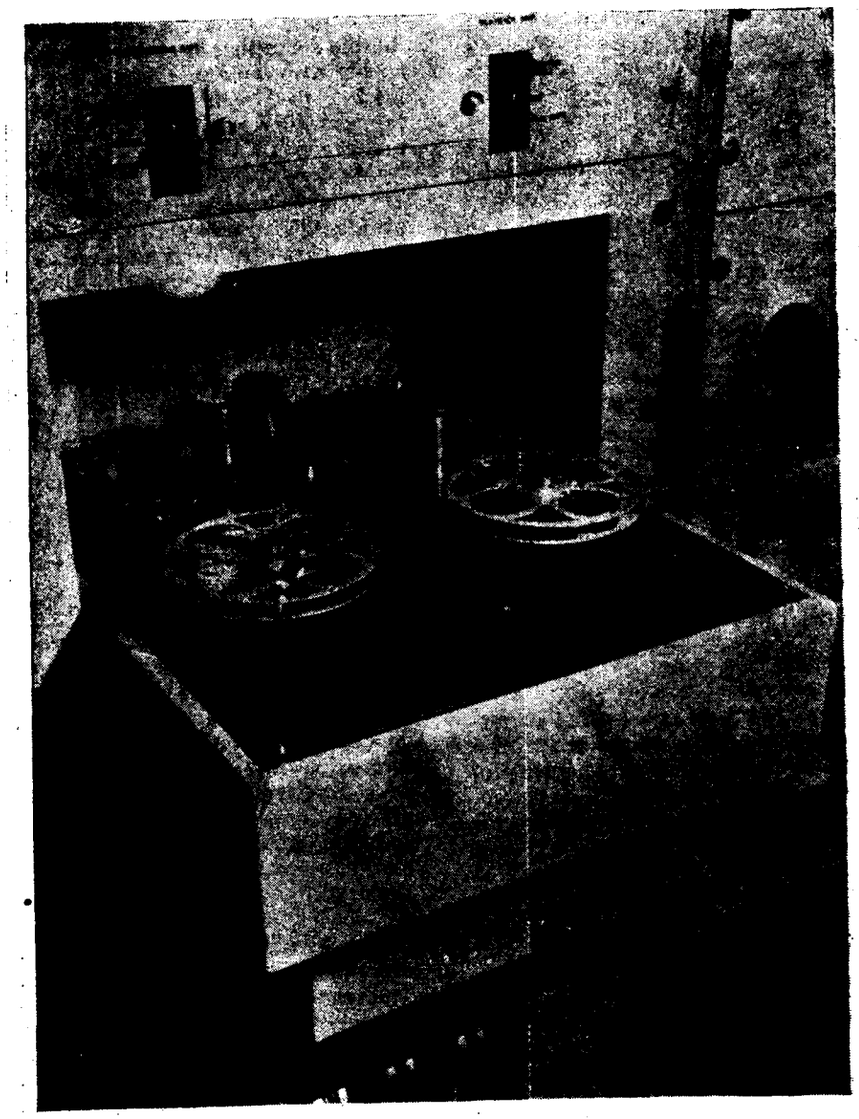


Fig. 2. Close up view of the desk carrying the spools of tape, recording, erasing and playback heads etc.

the operator is able to select the appropriate tape spool prior to the actual arrival, and fixes the spool on to the right hand mounting spindle. It should be noted that the left hand spool is captive, thus preventing the possibility of a tape becoming reversed. The leading edge of the tape is then guided past the constant speed drive Capstan around the automatic stop pillars, past the erase, record and reproducing heads, around the guide pulley and on to the "take-up" spool. As the leading edge of the tape has been reinforced it is pushed into the slot provided in the centre of the spool, the tape being locked and suitably tensioned by taking up

two or three turns. The associated control key is then switched to "monitor only" and the mechanism control key turned to "play and record."

Thirty seconds of blank tape has been allowed before the start of an announcement and the operator waits for the preliminary announcement which identifies the tape, giving its number, the language and brief details of the main announcement to follow. A space of five seconds is allowed before the main announcement begins and midway in this portion of the tape a strip of metal foil has been attached to the uncoated side. As this section of foil passes the switching pillars the auto-stop relay is operated and switches off the mechanism.

At the appropriate time the operator has merely to re-operate the main control key to "play or record" and change over the control key to "main amplifier." The complete recording is then reproduced over the loudspeaker system. At the end of the recording a further strip of metal foil has been provided and the mechanism is agian automatically switched off. At some convenient time the operator re-winds the spool and restores it in the appropriate can to the storage compartment.

METHOD OF OPERATION—LOCAL RECORDING

A special "recording" control key has been provided and by means of this a local recording can be made separately from the announcers' microphone or alternatively, such a recording may be made simultaneously with an announcement over the loudspeakers.

Therefore, when required, the "record" control key is operated as required and a blank tape threaded on the mechanism which is then started as described above.

To avoid accidental erasing or double recording of standard tapes, a separate and additional spring loaded pulley is provided which moves the tape against the erase and record heads.

The circuits have been so arranged that when either recording separately or simultaneously with station announcements the volume level meter on the announcers' control cabinet is in operation, thus ensuring that similar levels of recording are maintained.

TECHNICAL DESCRIPTION

From the above description it will be seen that simplicity is the keynote of this installation and that all controls, etc., have been reduced to a minimum.

Each spool of the tape gives a maximum announcement time of 6 minutes, excluding the 30 second run-up blank length. Rewinding is caried out at high speed in approximately 20 seconds and a "fast-forward" position is provided on the mechanism control switch to enable the latter part of an announcement to be selected if required.

A feature of the mechanism design is the ease of maintenance. The rear of the mechanism mounting is hinged and, after opening, the complete deck can be released and slid out on runners for examination. When required, the complete top plate carrying the heads, guide pulley, etc., can be released, giving ready access to the friction clutches, the two driving motors and the servo wheels. Oilite bearings are provided throughout and every precaution has been taken to ensure satisfactory operation under constant running conditions.

The "playback" and "record" amplifiers consist of separate units mounted at the rear of a common

panel on special brackets which allow ready access for test and maintenance. Simple and straightforward circuits have been adopted and the valve test meter has been made as simple as possible only giving a valve "goodness" reading.

The record amplifier chassis also contains the erase oscillator which provides erasing current and high frequency bias for recording at 60kc/s.

The power pack has been carefully designed to provide a well smoothed H. T. supply and separate L. T. supplies to the early stages of the playback amplifier. This ensures that under normal conditions noise and hum are kept at a very low level.

MASTER RECORDINGS

To ensure the best possible quality of reproduction on the station, master recordings were made under full studio conditions with high fidelity equipment. All of the 18 recordings were made at one continuous session with all four announcers in attendance. A single microphone was employed and so positioned above the announcers that equal speech level was obtained from the varying voices.

FURTHER DEVELOPMENTS

Similar arrangements for recorded multi-lingual announcements are being provided in connection with the installation of loudspeakers now being carried out on the "Hook Continental" Boat Train.

The Mysore Kirloskar Ltd., Harihar

Pioneer Industrial Engineering Enterprise of Maharastra

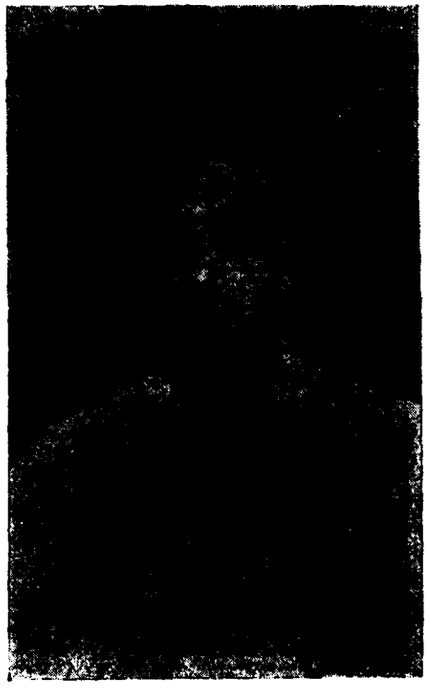
By T. S. N. Rao

THE Mysore Kirloskar Limited is yet another feather in the cap of the enterprising Kirloskars, the pioneers in the Industrial Engineering of Maharastra.

Situated at Harihar amidst a calm and picturesque surroundings, the factory is about 200 miles from Bangalore and 400 miles South of Bombay.

Within a comparatively short space of time, the Mysore Kirloskar Ltd., has made rapid strides in the manufacture of machine tools and is just now engaged in the manufacture of even certain categories of high precision tools.

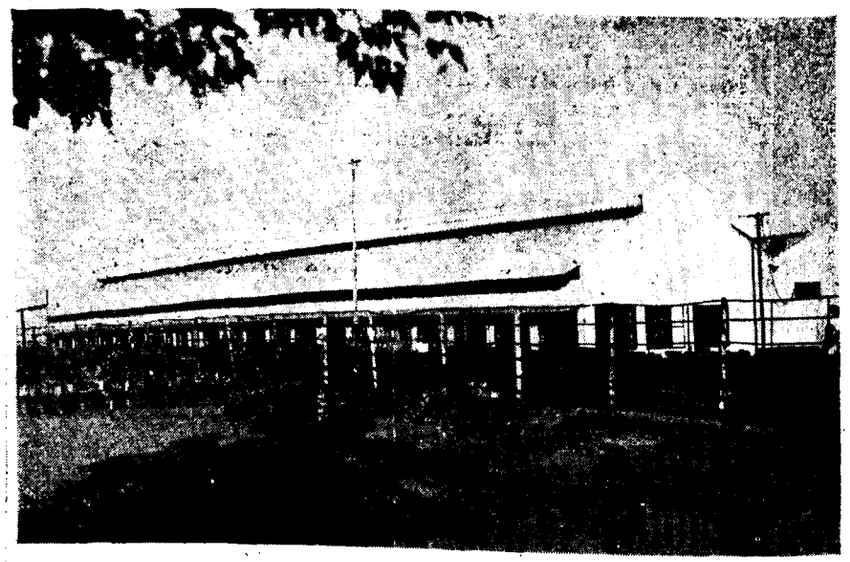
The factory which started manufacture of machine tools in early 1942 with a modest beginning, an entirely new field for Indian Industrialists, has progressed very rapidly and has now on its rolls about one thousand workers of whom nearly 300 are skilled technicians. The factory is engaged in the manufacture of precision machine tools, workshop machine tools, lathes, drilling machines, planing machines, presses and cutting machines of the highest quality that is produced inside the country. Proof of this is to be found in the ever-increasing demand for the manufactures of the Mysore Kirloskars from all over India, a demand that is rightly made by shrewd enterpreneurs but which is difficult for the manufacturers to cope with at present due to various causes.



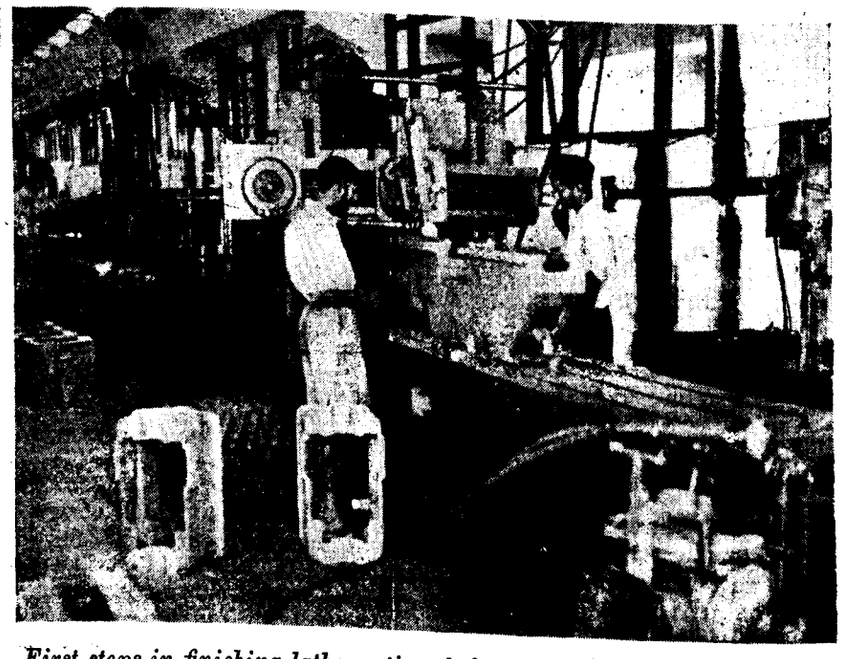
Mr. T. S. N. Rao

One of the popular manufactures of the Mysore Kirloskars is the "KIRLOSKAR STEEL PLOUGHS," thousands and thousands of which have gone all over India in the hands of our hard-worked farmers who are to-day fighting every inch with the land to produce more and more foodgrains for the starving nation.

Kirloskars who run this factory at Harihar, have earned a name for themselves in the efficient management of the Industrials under their control in some parts of Bombay

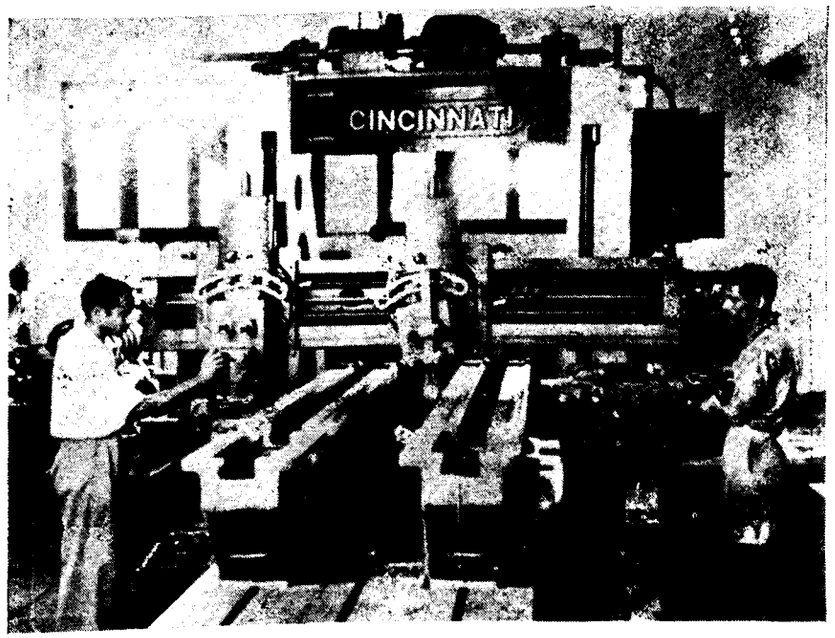


General View of the Mysore Kirloskar Ltd., Harihar

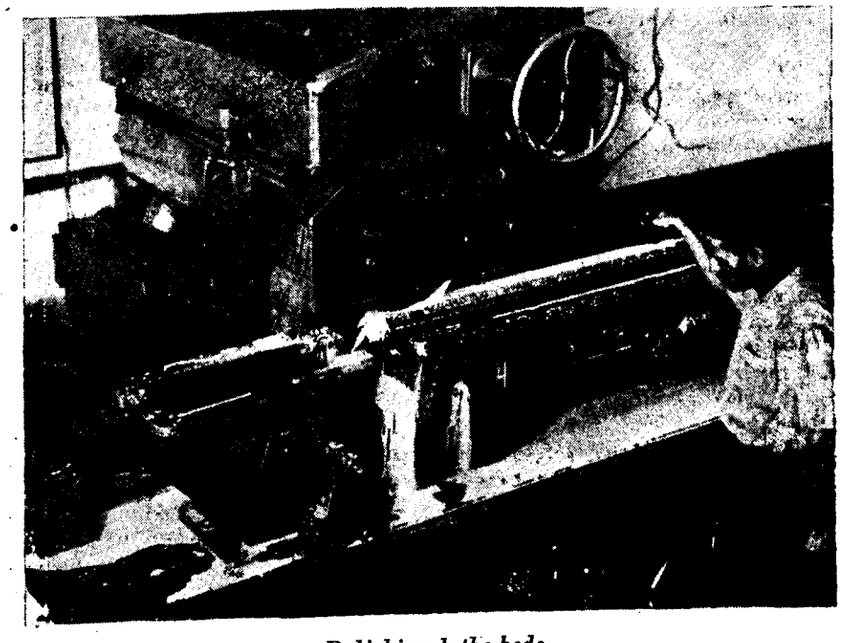


First steps in finishing lathe casting, before six months seasoning period

and Mysore. Their capacity to deal with labour fairly and squarely is well known and they can well be described as Industrialists who "move with the times." To them the "contentment of labour" in their establishment is as much an essentiality as is the urge to satisfy their clientele with their quality manufactures.

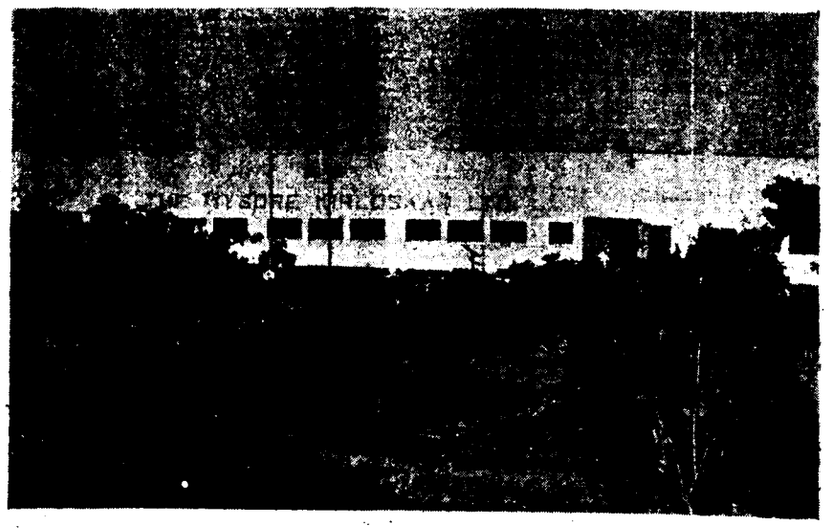


Finishing lathe beds



Polishing lathe beds

The Kirloskar Factory at Harihar is no exception. This Industrial Establishment though small, is an ideal one particularly from the labour point of view. This factory has had no strikes and no lock-outs ever since its inception in spite of the strenuous efforts of some



Panoramic view of the Mysore Kirloskar Ltd., Harihar

of the local political parties to create industrial unrest in the small area. The only exception, it is stated, was a short strike in 1949 but with negligible loss of man-days.

The reason for this "thorough industrial peace" in the factory is the contentment of labour working in the establishment which in turn is due to the fair and square deal of the management to the labourers.

The labour engaged in this factory is paid satisfactory wages and other allowances and is enjoying besides various other amenities. Free medical help is rendered not only to the labourers but also to their families. The management have provided the children of the workers with free educational facilities, besides an Industrial Canteen where the worker after his hard day's work gets quality meals at a comparatively low cost. Workers are also enjoying the facilities of a cheap foodgrains shop, extensive playgrounds and free sport materials to the children.

Flanking the factory is the Kirloskar Colony with its well laid out roads and residences of skilled technical and other supervisory staff.

The Management have recently sponsored a new scheme under which some of their skilled and efficient technical staff are sent to other Institutions in India and even abroad for further advanced training. The Factory has a well-equipped laboratory for testing their products and a hospital with all the modern facilities.

The Management is vested in the able hands of Rao Bahadur M. B. Jhambekar, General Manager and Mr. R. L. Kirloskar, Deputy General Manager. Young, energetic and agile R. L. Kirloskar, with his valuable engineering knowledge gained abroad, is an asset to the Management especially in the Foundry Section where he actually works day in and day out by the side of his workers, giving them valuable guidance now and then.

The medical requirements of the factory employees are attended to by Dr. S. N. Dhananjay.

The factory was visited by a team of Czech Technical Experts in 1949 and another team of Swiss Experts in 1950 who after seeing various sections were very much impressed with the work done here.

It redounds to the credit of the Management the remarks recently made by Mr. S. A. Venkataraman, I. C. S., Secretary to the Ministry of Industries and supplies, Government of India, on the working of this factory. He said "Kirloskars are managing their Harihar establishment so nicely that they have surpassed all other institutions producing machine tools in India."

Cigarette smoking and coffee and tea drinking are not necessities of life. Some take 10 cups of coffee a day. Is it necessary for keeping them awake for the performance of their duties? If that is so, let them not drink coffee or tea but go to sleep. We must not become slaves to these things. Cigars and cigarettes, whether foreign or indigenous, must be avoided. Cigarette smoking is like an opiate and the cigars that you smoke have a touch of opium about them. How can you foul your mouth by converting it into a chimney? A drunkard in Tolstoy's story is hesitating to execute his design of murder so long as he has not smoked his cigar. But he puffs it and then gets up smiling and saying 'What a coward am I', takes the dagger and does the deed. Tolstoy spoke from experience. He has written nothing without having had personal experience of it. And he is much more against smoking than against drink. But do not make the mistake that between drink and tobacco, drink is a lesser evil. No. If cigarette is Beelzebub, then drink is Satan.—M. K. GANDHI.

Paint Protection—Problems and Points of View

By G. H. Gates-Reed, M. I. A. M. A.

The opinions expressed are those of the writer and are not necessarily endorsed by any paint organisation or manufacturing concern.

IN view of the avowed and highly creditable aim of the editors to make this Engineering Supplement a tribute to the efforts of "the Railway Engineers and other Technical Staff in the development and construction of Railways and other allied projects in this country" (to quote the Associate Editor), I fear that at times, I am going to appear as something of a "spoil sport." For with my subject as paint in all its diverse relations to Railway operation and construction, it seems inevitable that a lot of grousing will have to be done. Grousing, which however, when related to the over-all scheme and progress of Railway matters, in no way diminishes my enthusiasm for all that has been achieved; and grousing which is considerably offset by the fact that the main complaint is already being acted upon, as is discussed later.

A quotation will take us to the heart of the matter. I was reading the Annual Report of the Vice chairman of the Paint Federation (the Chairman was indisposed) when I came across the following quotation:

"The various types of Synthetic Coatings which the leading manufacturers have been supplying to the Railways under recognized brands are of a consistent quality evolved after many years of technical endeavour and, what is equally important, after long and searching practical tests. These tests have, in the past, been carried out with the collaboration of the Government Test House and by the Railways, themselves. The value of paint as a protective material can be determined only by its ultimate performance and no ingenious accelerated tests by weatherometer or other apparatus have yet constituted satisfactory alternatives to full-scale exposure trials under service conditions. The Railways undertook searching tests before the war and were able to establish the fact that despite their comparatively high initial cost, high grade synthetic materials, on account of their extra durability, provided substantial economies by enabling coaching stock to remain longer in service before coming into shops for repainting."

Mr. G. H. Gates-Reed

I felt immediately that whether one was on the selling or the buying end of the business it would be difficult to refute that statement although possibly one might put forward—hesitantly I hope certain suggestions for not quite abiding by the letter of it for the present; as has been and is being done. None-the-less, a great deal of ground is covered in that statement and a great deal has been left unsaid because, to those concerned, it does not require elaboration. Reading between the lines is not difficult; and there was born my grouse!

Without any doubt there has been an inclination all round of late, (and the Railways are certainly not the only party concerned) possibly in a genuine although as we shall see, misguided desire to affect immediate economies, to buy paint on price and laboratory tests alone. In that respect, if I may be pardoned, I would like to quote from my article "Those Things We Ought To Have Done" which appeared in the November issue of the Southern Railways Magazine; words which emphasise the whole sad story:

SPRAY PAINTING OF WAGONS

This photo shows the correct height for the staging in painting wagons. It also shows the lowest position for spraying from the particular stage, to attempt to reach lower results in an unsatisfactory coating.

"Specifications are not nor can they ever be a complete check in themselves on the quality of a product. In fact, it was never intended they should be so; they are a guide, the Lowest Common Denominator as it were, from which to start. Only performance under actual conditions of normal usage will supply the answer as to suitability." The rider to which is that only the best quality products can possibly stand up to usage—particularly under Railway working conditions.

Again, of course, the best is not likely to be the cheapest; it cannot be if the best in technical formulation, materials and manufacture is to be provided. For one could be brutal about it and say that it is relatively simple to produce very cheaply indeed a substance that looks and smells like paint, that temporarily will even behave like paint—but for how long will it look good and do its very important job? Is it sensible to expect it to last long? That is the approach that ultimately must always govern the economics of painting. Today, the actual labour cost of application is as much as three times the cost of the paint and primers, even when purchasing the most expensive products. Obviously therefore, the true economy is to use paints which keep the repaint interval as LONG as possible within the safety limits. The costing is simple enough—yet many are still prepared to save a little today on initial outlay, presumably letting the future, the very near future at that, look after itself.

This approach was laboured in my earlier article; it cannot be over-emphasised. Operating conditions in India are as hard on a paint film as they possibly could be—great changes of temperature, the continual abrasive effects of dust, oily soot deposits from indifferent coal, in fact hazards so great that it is miraculous that paint films last as long as they do. And that is thinking in terms of well prepared synthetics—which indeed are not the cheapest but which will certainly last the period expected of them, they are formulated to do so, and enable the laid down six year period between full repaints to be worked to. The intermediate treatment periods are eighteen months, three years and 4½ years for carriages. Without any fear of contradiction one can assert that in recent years paints have been purchased which, to use a vulgarism, "hadn't a chance in hell" of lasting anything like long enough to enable the above schedule to be adhered to. Where then is the economy in buying on lowest price and without subjecting samples to the severest operational tests first?

An excellent example of the need for rules and of adhering to them—provided of course, as one would naturally assume, they are based on experience, time and practice tested, is contained in the following extract from the result of an enquiry into a fire which was widely reported in the general press at the time.

"As a result of an inquiry into a fire which broke out in Edinburgh—King's Cross Express where two coaches were destroyed, the Inspecting Officer of Railways has issued his findings. It was stated that the rapid spread of the fire was caused by the clear cellulose lacquer with which the walls of the corridor had been sprayed, and accelerated by draughts of air through the corridor.

"Certain features have given rise to deep concern. These are—the ease with which the fire started, the suddenness of the outburst, the immediate intensity of the flames, the asphyxiating nature of the gases produced and, above all, the extreme and dangerous rapidity with which the flames spread."

The coaches were built for the L. N. E. R. in 1947, and the properties of the paints specified were reasonably safe and well known, but at some stage a deviation from the contract to allow for the use of clear cellulose must have been requested or permitted by the Railway Company.

"The inspector recommends the advisability of stipulating the lowest permissible classification of inflammability of all materials which may be used in passenger-carrying coaches. He also urges that no new material should be adopted until it has been tested and until it is known that it falls within the prescribed category.

In a way, as I was happy to indicate at the outset, the grouse is not as severe as it might have had to be for at the time of writing it is known that the Railway Board intend to work towards a return to paint standards, a fact which in itself adequately supports this argument. It is absolutely essential in the interests of Railways maintenance and economy, and in our heart of hearts we have known it to be so all along.

At the risk of becoming a bore I would again refer readers to the 1938 Government Publication "REPORT OF THE PAINT TECHNOLOGIST APPOINTED TO SUGGEST METHODS BY WHICH IMPROVEMENT IN THE

CLASS OF PAINT AND PAINTING MATERIALS AS AFFECTING THE INDIAN RAILWAYS CAN BE EFFECTED." Yes, we know all about it; it has been read before; but well, much has yet to be done to put the theory into practice— more than simply embodying many of the suggestions into the I. S. D. Standard Specifications. As with all laws, or rules or standards, the letter of interpretation at operation level is in the hands of a great many individuals so that in reality the law, the system or whatever it is, stands or falls by that interpretation, and the individuals' loyalty to a tried system.

Incidentally, F. Fancutt, who was responsible for the above mentioned report, and who at the time of producing it in 1938, was Chief of the L. M. S. Test Laboratory, Derby, has been appointed (promoted) Superintendent (Chemical Division) at Euston, under the new integrated Research System. He becomes one of seven Superintendents of the new divisions.

The details of this single Research Department for the whole of British Railways, under the Railway Executive, which came into operation on January 1st, 1951, reveals an interesting organisation. In the following resume of the new set-up I would point out the emphasis given to paint research which has its own Protective Coatings Division as well as being within the scope of the Chemistry Division (Fancutt, Superintendent):

There are seven divisions each under control of a Superintendent:

1. Chemistry, embracing existing laboratories in each region. These laboratories will continue to be concerned with work arising in the regions, but major researches of a chemical nature will be allocated to whichever laboratory is most suitable. The laboratories are situated at Ashford, Crewe, Darlington, Derby, Doncaster, Glasgow, Horwich, Stonebridge Park, Stratford, Swindon and Wimbledon Headquarters in London.

2. Engineering.
3. Metallurgy.
4. Protective Coatings.
5. Physics.
6. Textiles.
7. Operational Research.

Divisions 2 to 6 will be located at Derby, where the necessary laboratory facilities and staff already exist; there will also be a subsidiary engineering laboratory at Ashford. Headquarters of 7 in London.

CONCLUSIONS

With the important administrative changes taking place in the organisation of India's Railways it is to be hoped that the significance of paint research and of the need for setting standards by operational tests, in fact that the implementation of most of the recommendations made in the Fancutt report, will obtain a new lease of life. Indeed they can be improved upon, as all things usually can be, in the light of the working experiences gained by our Railway Engineers and Administrators during the twelve years that have elapsed since the report was put forward.

There are many other angles to paint usage and application which we have not referred to here. The painting of railway stations, bridges, equipment generally; the importance of selecting sound colour schemes for railway coaches with an appreciation of the aesthetic, pyschological values of different colours; and lastly the maintenance of carriage cleaning standards are all in themselves subjects for constructive articles.

Standards! That then, is the key word and in all of the uses of paint in relation to Railways, it is a fact that time and experience has shown to be correct that— there is no economical gain in using cheap or inferior materials, in trying to short cut correct application methods, in putting off repainting when it is due. With locomotives and rolling stock the application problems are many and more complicated than when dealing with buildings generally. But the railway station, the signal box, the bridge, the carriage workshop are all subjected to the same destructive influences, climatic, chemical, general wear and tear, as is rolling stock. It is as necessary therefore, that their preservation through paint protection should receive just as much technical attention.

We must never forget in an age of ever rising prices, that the capital equipment under our control is a valuable National Asset costly to replace—that it must be used therefore to maximum advantage, and that all measures must be taken to ensure it performs well its agreed function for as long as possible.

In this respect paint can play well its proven role of protective and preserving agent to any correctly prepared surface to which it is properly applied. It is not surely out of place to mention finally that India is to-day rapidly finding herself in the position to supply all these important paint products from indigenous sources nor is there any question about the excellent standards maintained by the leading manufacturers.

Aluminium Rides the Rails

By Subramoniam, M.P., B.Sc., B.Sc. (Eng.)

IN recent years the progress made by the aluminium industry has been so spectacular that various countries have realised the use of aluminium in almost all walks of life (but not to such an extent in India). Houses and hedges, bridges and barges, ships and airplanes, storage tanks and pipelines, railway coaches and motor buses (to mention only a few)—all shining in the lustrous whiteness of this metal—are not too uncommon in their everyday life. It will require volumes of pages if I want to do full justice to the use of this "wonder metal" and so I propose in the following paragraphs, only to dwell upon the successful application of aluminium in the construction of railway coaches, railway stations and platforms.

Mr. Subramoniam, M. P.

The principal countries of the World like Canada, U. S. A., France, England and Switzerland have all realised the paramount advantages of aluminium over steel in the railroad industry. Ease of fabricating and finishing the metal is one of the reasons for the choice of aluminium. Cost comparisons should be made on the finished article as made from the different possible materials, and not on the relative prices per pound. Moreover, economies result from the greater ease with which aluminium can be fabricated, polished or otherwise finished, and also from the lower cost of distribution made possible by the lightness of the metal. These economies are more than sufficient to overcome an unfavourable cost comparison from the standpoint of metal value alone as with the common grades of steel. While making such comparisons the higher scrap value of aluminium is always an advantage to be considered. Its light weight, durability, resistance to corrosion, and high strength are largely responsible for the structural application of this metal in the transporation industry.

Aluminium, as itself, is not widely used for structural purposes; wrought alloys of aluminium produced by rolling, extruding, drawing or forging to suit the purpose for which they are required, have hence been used. A table of the mechanical properties of steel and aluminium alloys is given below for a comparative reference. It is to be noted that only an average value applicable to all aluminium alloys is quoted therein :—

Property	Steel	Aluminium Alloy
Weight.	0·284 lbs./Cin.	0·099 lbs./Cin.
Modulus of Elasticity.	30×10^6 lbs./Sq. in.	$10{\cdot}3\times10^6$ lbs./Sq. in.
Modulus of Rigidity.	12×10^6 lbs./Sq. in.	$3{\cdot}9\times10^6$ lbs./Sq. in.
Poisson's Ratio.	$\frac{1}{4}$	$\frac{1}{3}$
Ultimate Strength.	67×10^3 lbs./Sq. in.	30×10^3 lbs./Sq. in.
Allowable Working Strength.	17920 lbs./Sq. in.	13500 lbs/Sq. in.
Coefficient of Expansion.	0·0000062	0·000017

The economic advantages which have proved to be substantial indicate a rapid expansion in the use of aluminium in Railway transportation where the relationship between dead weight and carrying capacity is of vital importance to operators. An example of the effect of aluminium on operating costs was the recent introduction on Canada's Roberval and Saguenay Railway of an aluminium box car weighing six tons less than the standard car and believed to be the lightest car of its size and type in existence, with a record breaking increase in carrying capacity. Increased freight deliveries of 800 tons per day have been achieved by the use of 80 aluminium hopper cars for its rolling stock. In other countries also, experience has proved that the reduced weight of the rolling stock can be translated into increased carrying capacity and lower operating costs. These economic advantages are available not only in freight cars but also in passenger cars and locomotives where the metal has been used for the cab, cross head shoes, doors, partitions, floor plates, fans, loures and conduits, running boards, steps and rails, sandbox and tubing and smoke deflector among other things.

Recently an all aluminium Railway Inspector's Car with its

rear lift weighing only 100 pounds has been made and put to use in Canada. The London Transport Executive has placed an order for some underground trains with aluminium bodies, the first of their kind to run in Great Britain. It is known that some 30 tons of aluminium alloy will replace 60 tons of steel in such a normal eight car train. The Diesel electric locomotives so popular in North America have been made of aluminium castings and structural members. It will be interesting to note in this connection that the Australian "Silver City Comet," one of the early trains to be constructed largely of aluminium has been in excellent operation since 1937.

A new moving railway bridge, first of its type in Scotland, is to be built over Victoria Dock in Aberdeen. The two track railway bridge will combine aluminium and steel, aluminium being used as a weight saver for the entire movable section thereby lessening the power required. The flexibility of the metal—strong as steel and weighing only half as much—together with the ease and efficiency with which it can be assembled and dismantled makes aluminium an ideal metal for certain types of railway bridges. The extrusion process in the aluminium industry permits channel, T, Z and I sections to be produced easily. Beams can be designed with light riveting flanges and heavier free flanges and decorative shapes like handrails can be made without much cost. Speed and efficiency in erection and low maintenance cost are factors of importance in bridge construction. Moreover, in aluminium structures, secondary stresses resulting from temperature changes are less than those in similar steel structures because the lower modulus of elasticity of aluminium compensates for its greater coefficient of thermal expansion. The lower modulus of elasticity is an asset when impact loads are to be resisted and it is also advantageous in reducing stresses produced by misalignment, settlement of supports, or other fixed deflections.

Aluminium furniture, if used in railway coaches, reduces dead weight, lends brightness and beauty to its surroundings and lessens the power required for haulage. Anodized and dyed aluminium sheet in colours provides attractive walls and ceilings for passenger cabins. The Canadian Pacific Railway advertised as "The World's Greatest Travel System" is widely replacing the wooden leaders with aluminium ones for getting into the upper berths of sleeping coaches. The aluminium unit weighs only 16 lbs. nearly 30% less, and can be folded flat when not in use, thereby saving much space. Recently aluminium has been used in rebuilding passenger cars of India's North Western Railway making extensive use of castings with anodized sheet products. The uses include seat pedestals, berth frames, wash basins and windows. A much wider use of aluminium is found in the light weight six coach Paris Strasbourg Express which is furnished with more than 75% of aluminium.

Experience regarding the insulating properties of the metal has shown that the outside of coaches remains warmer in winter and cooler in summer and it is credited with providing as much insulation as ten inches of light brick. Experiments made with steel doors and aluminium doors have shown that with the sun on the steel door the outside temperature is 107°F and the inside 105°F, while with the sun on the aluminium door the outside temp: is 104°F and the inside only 86°F and hence the reflecting properties contribute to more comfortable living. This special advantage of the metal should find favour in a country like India where we are exposed to the scorching heat of the sun for most part of the year. With this end in view, special batts for use in the thermal insulation of rolling stock particularly refrigerator cars have been ordered by the Canadian Pacific Railway. The batts contain fibre glass in asphalt impregnated paper bags faced with aluminium foil which enhances its heat reflecting properties.

Aluminium alloys, especially if coated with aluminium paints, have very good resistance to atmospheric corrosion. The resistance is explained by its property of forming a thin firmly adherent coat of oxide on its surface which prevents further action. The fact that aluminium is highly resistant to the action of weather is demonstrated by the aluminium capstone on the tip of the Washington monument. It was placed in its position in the year 1884 and though, for over 66 years, it has been exposed continuously and been hit by hundreds of lightning strokes, on examination, engineers have found it to be in such a good condition that the original engraving could still be read. The corrosive fumes such as sulphur gases from burning coal have no damaging effect on aluminium. The successful use of the metal for the roofs and sides of Railway passenger coaches and locomotive round houses gives evidence to this fact. A notable example of an aluminium roof for a Railway Station is the one installed in Milan, Italy, internationally renowned for its style of architecture. Aluminium was chosen because of its durability and aesthetic beauty. Hence for Railway Stations situated near the seacoast and industrial areas aluminium structures offer the best protection. Because aluminium is highly corrosion resistant, aluminium metal tanks have been used in U. S. A. on a large scale for storing and conveying oil, petroleum, water etc., to distant places.

Compared to other paints, the leafing action of aluminium paint increases its hiding power. The continuous metal coat formed by overlapping aluminium flakes gives the paint unusual resistance to moisture. It has been established that aluminium coated steel has high rust resistant properties suitable for industrial and seacoast exposures and in humid atmospheres it has been found superior to steel with galvanised coatings of similar thickness. Aluminium enamel has a very high resistance to heat and does not discolour on heated surfaces up to 800°F. It will protect against the rusting of boilers, steam pipes and water-heating systems. On furnaces and other heated surfaces it reduces radiation and thus saves heat and promotes the comfort of workers.

In short, the dollar and cents advantages of aluminium alone appear today to be the most promising ally in the struggle of Railroads against rising operating costs.

Let us eagerly await the day when the wonder metal aluminium will ride the Rails in India.

In a change of government, the poor seldom change anything except the name of their master.—PHAEDRUS.

History of Electric Railways in Switzerland

By Matthias Wittgenstein, Grad. Engineer

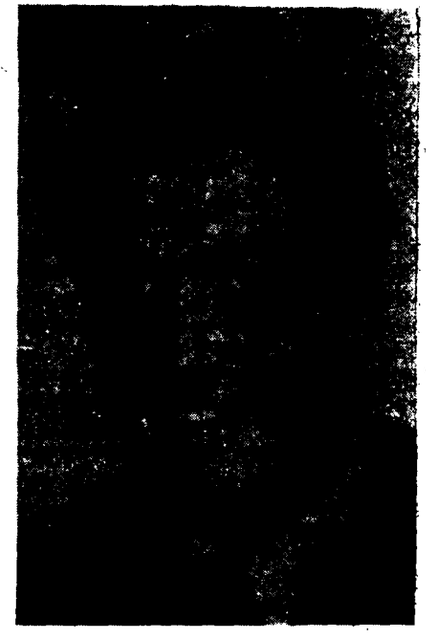
GENERAL ASPECT AND DEVELOPMENT

Switzerland is a tiny country, lying in the heart of Europe between France and Austria, Germany and Italy. By reason of this geographic situation, Switzerland is naturally one of the main junction of European traffic, and its commerce and industry are correspondingly highly developed.

The area of Switzerland is about two thirds that of Ceylon, and 58% of it are Alpine regions. The population is approximately 4.5 million, 22% of which are occupied with agriculture, 41.2% in industry and 16% with commerce and transportation. Thanks to her universally admired natural beauties, Switzerland is the favourite health resort and playground of ever increasing numbers of international tourists all the year round, and its railway system is well adapted to accommodate them. The 2,280 m.m. = miles of mainlines (1,435 mm. gauge) are operated by the Swiss Federal Railways, popularly called SBB (abbreviation of Schweizerische Bundesbahnen), whereas the approximate 1000 m. of secondary lines (1000 mm. gauge) belong to various private companies.

The Swiss Railways run through no less than 667 tunnels, measuring a total of 187 m., the three longest of which are the Loetschberg tunnel (9.2 m.), the St. Gotthard tunnel (9.4 m.) and the Simplon tunnel (12. 4m.).

In the beginning of this century, the Federal Railways urged the exploitation of the



Mr. Matthias Wittgenstein

abundant but not yet harnessed natural hydraulic power, dormant in the Alpine streams. A change-over from steam to electric traction would not only render the Swiss Railroads independent from the essential and costly supply of foreign coal (Switzerland has neither coal, nor oil, nor iron ore), but would also reduce running expenses considerably. At that time, some experience regarding electric traction had already been collected, restricted, however, to minor track lengths and to a DC system, a traction system that had become generally popular, due to the favourable qualities of the DC series wound electric motor and the possibility of using storage batteries. After most of the power plants at home and abroad had

changed over to the three-phase system in the 90's, it was only natural for the Railway Companies to follow suit. This AC system allowed of the use of higher voltage, thereby achieving greater motor power, but this was accompanied by the disadvantage of a constant motor speed and a three-pole supply of current.

After several minor three-phase Railroads (built by the Swiss Brown, Boveri Company, Ltd.) had started running in Italy and Switzerland, this same Company ventured the installation of three-phase traction for the short stretch of the normal gauge Federal Railways running from Burgdorf to Thun, and in 1899 this was the first Electric Railroad in Europe to be operated with 750 V contact line tension and the then being industrial frequency of 40 cycles. The lion tension being restricted by government regulations, the network had to be fed by a number of transformer stations, on an average 2 m. apart from one another, at a primary tension of 15,000 V. The two-pole nature of the overhead lines gave rise to certain construction difficulties in relation to details at station switch points which could, however, satisfactorily be overcome. Already at that time, the joint operation of the Railroads together with the communal hydraulic power supply caused noticeable power fluctuations.

In 1906, after negotiations with the authorities regarding the admission of a higher voltage and in conjunction with the electrified line on the Italian side of the Simplon tunnel, the SBB running through this tunnel was the first mainline to start operating with three-phase [illegible]nt at high contact line tension [illegible]V). The Swiss Brown, [illegible]ny, Ltd., undertook [illegible]d operation of [illegible]00 V line [illegible]lied by the Swiss power station at Massaboden.

This installation constituted the final stage in the development of the three-phase traction system in Switzerland, for parallel tryouts with the single-phase system by private companies had already met with considerable success. This development came about quite naturally, as the dual overhead line essential to the three-phase system drew narrow limits to the contact line voltage. On the other hand, the reliability of the single-phase motors was offset by their inability to produce the greater traction power constituting a basic repuirement for main Railway lines. It was left to private intiative to find the most suitable solution. For the time being, this was achieved in the roundabout way of converting the high voltage wire current to DC in the electric locomotive itself.

At the suggestion of Mr. E. Huber-Stockhar of the Maschinenfabrik Oerlikon (Switzerland), the frequency of the AC was simultaneously reduced to one third of the industrial frequency of 40–60 cycles (now 50 cycles). To a great extent this was due to the voltage drop caused by using the tracks for the reverse current. Thanks to the initiative of the Maschinenfabrik Oerlikon, and with the permission of the Federal Railways, it was possible to begin operating according to this system on the test stretch. Seebach-Wettingen with a 700 HP converter locomtive using single-phase current at a contact line tension of 15,000 V, 15 cycles. Almost at the same time, Dr. Behn-Eschenburg of the Maschinenfabrik Oerlikon succeeded in solving the problem of single-phase traction by improving a single-phase series collector motor with a displaced phase auxiliary field, thereby eliminating the commutation difficulties thus far encountered in general and

more especially, in connection with high motor output.

The Maschinenfabrik Oerlikon immediately set about the practical exploitation of this invention by building a further locomotive driven by two motors of this type of 250 HP each.

Already in 1902, in the course of a lecture he held before the Zurich Society of Engineers and Architects, Mr. E. Huber-Stockhar, a pioneer of electrical engineering, had advocated the idea that, if electric traction was to become generally accepted for main Railway lines—and to do this its performance would have to at least equal that of steam locomotion—this could only be achieved for lines of great length and with steep gradients, such as, e. g., the St. Gotthard line, by using single-pole contact lines of high voltage.

The method for further developing the single-phase Rail-road system with all its advantages for mainline operation had now been found.

In 1909 studies for the electrification of the Loetschberg Railway, then under construction, were begun. A year later, the Rhatische Bahn, serving the popular winter resorts of the Grisons, decided to electrify from the beginning on all its stretches then being constructed. And shortly before the out-break of World War I, both companies started operating electrically: the Loetschberg Railway with direct feeding of the contact lines from the powerplant (16,000 V, 15 cycles), the Rhaetische Railway by converting the 50 cycle three-phase energy into a line tension of 10,000 V at a frequency suitable to the rotating converter of 50/3= 16 2/3 cycles.

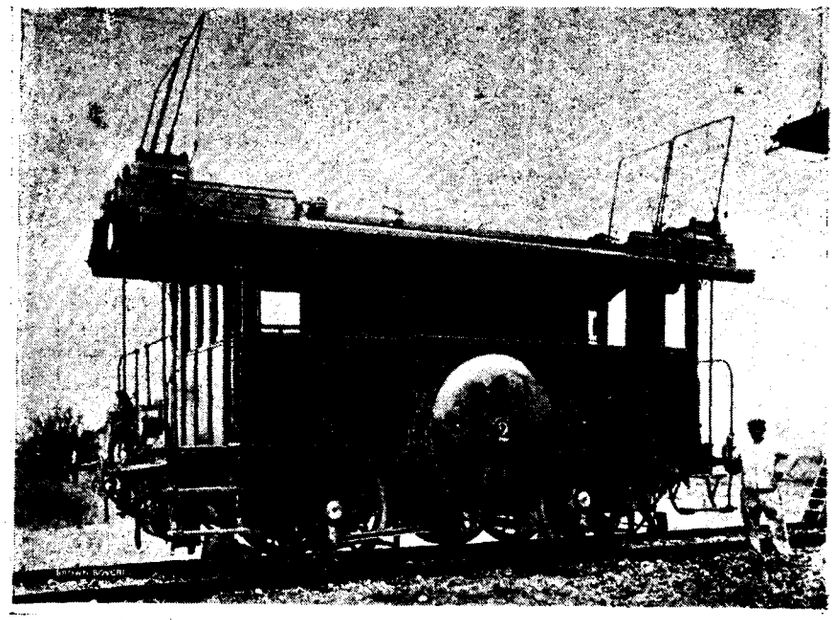
After the private Railroad Companies had completed these various stages of development, the operating tension of the SBB was definitely fixed at 15,000 V single-phase AC with the frequency of one third of the 50 cycle industrial frequency, i. e., at 16 2/3 cycles. This tension is transmitted through the contact line to the locomotive, where it is brought down to the motor voltage by a transformer.

Some thirty-five years have passed since the Swiss Federal Railways made the memorable decision in 1916 to begin electrification which was carried through at steadily increasing speed, in spite of changes of fortune during the latter half of the war and the following years of a prolonged depression, but spurred on by the success and advantage in utilizing the national hydraulic power. Probably never more strikingly was the immeasurable advantage of the electrification of the SBB and private railroads brought home to the Swiss people than during World War II, when the entire railway system was uninterruptedly and without restrictions available, not only to the army, but to business and industry as well as to every individual citizen. To-day 93% of the SBB network are electrified and handle 97% of the total SBB traffic.

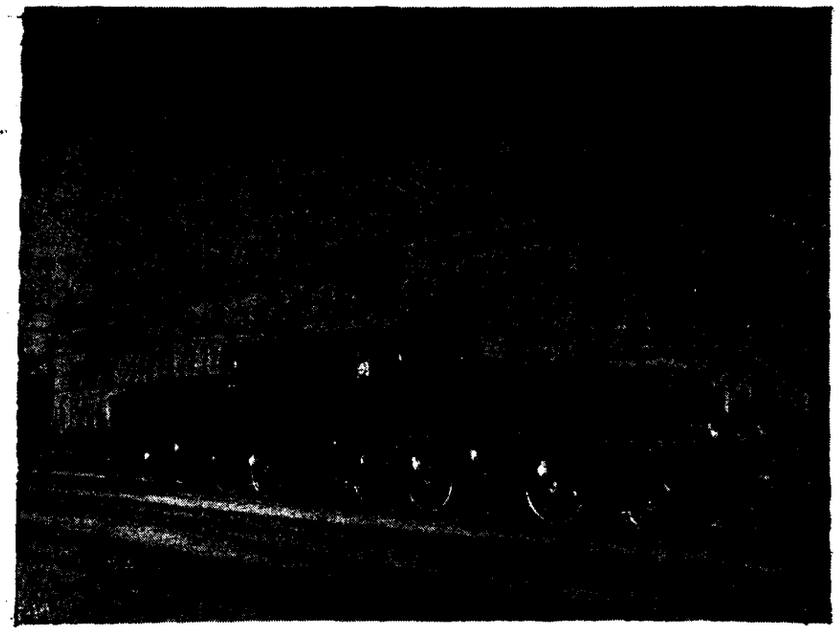
In 1946, e. g., the yearly power requirements amounted to approximately 827 million kw-hr which equal about 7% of the total Swiss electrical power consumption The greater part of this power is generated in low or high speed hydraulic power stations owned by the SBB, in some of which there are also generators for the industrial frequency of 50 cycles, so that surplus energy can be supplied to industry.

THE ELECTRIC LOCOMOTIVE OF THE SBB

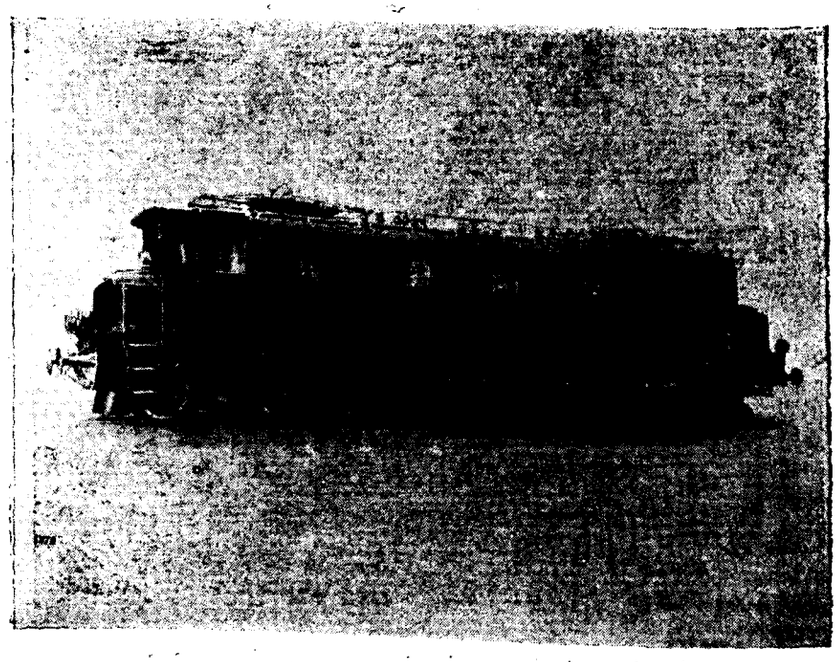
It would be interesting to treat of the developments in the



First Electric Locomotive for main line in Europe



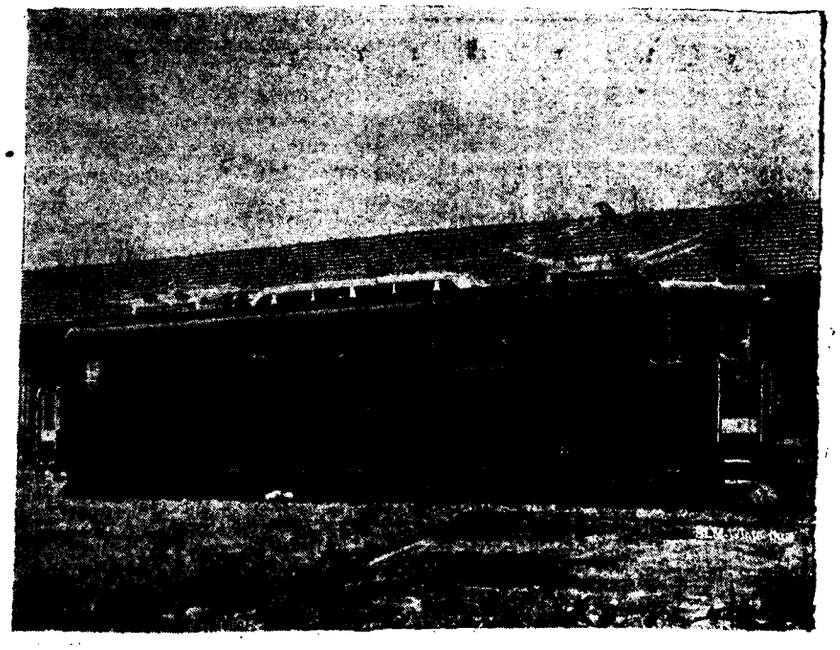
Goods-Train Locomotive



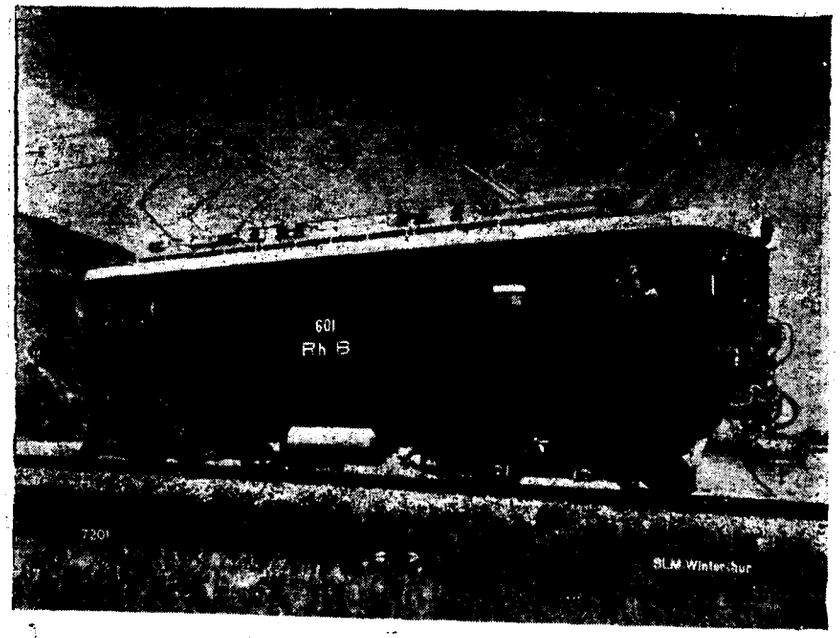
Express-Locomotive

Gotthard-Express-Locomotive—Strongest Electric Locomotive in the world

Fast-Train



Express-Locomotive



Locomotive Mountain Type

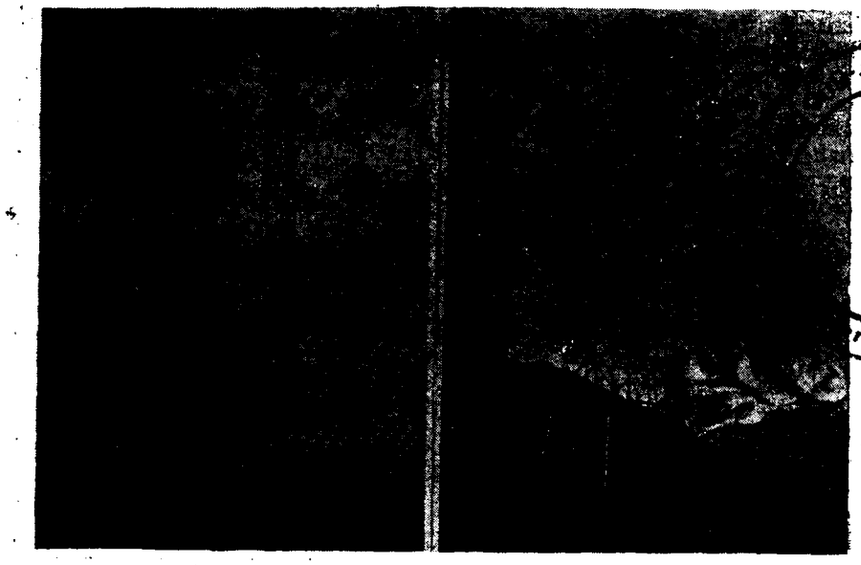
construction of electric locomotives, but lack of space permits only of mentioning the most important types.

FEEDER AND TRANSMISSION LINES

Twenty-four sub-stations for converting the tension for feeding the contact line sections are distributed over the SBB system. Being transformer stations, they are connected, on the one side, at high tension by transmission lines of 66 and 132 kv with the power-plants and, on the other side, at tension of 15 kv by feeder lines with the respective line sections they serve. Due to the high tension of the transmission lines, these sub-stations could be spaced far apart and were generally located at junctions of the railway system. Further five 15 kv feeding points are located along the lines. Four other transformer stations for individual line sections are situate at the periphery of the current supply network.

Transformers with preponderantly small power output of from 3000 to 6000 kVA have an externally water-cooled oil filling and are provided with alarm signals, functioning when the circulation of the cooling water and oil is interrupted or when the cooling temperature rises too high.

The sub-stations are responsible for repairing breakdowns and localizing disturbances of their respective section of the network. Due to mechanical wear on contact lines, disturbances occur, although not too frequently, generally in the shape of temporary or permanent short circuits. For this reason, the single-pole feeder switches for the 15 kV feeder lines leading to the line sections are of an especially short circuit-proof design and are provided with devices for the finding of defective sections and for the rapid isolation of short circuits. The feeding point switches of more recently built sub-stations, operating fully or



66 and 132 kV transmission line erected by Kummler & Matter, Zurich

semi automatically, there is no need for the constant presence of an operator at the switchboard. A network of transmission lines connects the power plants with the sub-stations as well as with one another for the exchange of energy with working voltages of 132, 66, 60, and 35 kV.

For the first electrification of the St. Gotthard line in 1913, transmission cables were laid, having a working voltage of 60 kV, as based on the experience of the Swiss cable industry of that time. For the rest, the transmission lines were strung overhead, the spans measuring on an average 410 ft. in the lowlands and from 1310 to 2300 ft. in the mountain valleys. Several transmission lines are strung over long distances together with public utility lines and supported by common masts. Most of the conducting material consists of copper cables. The 132 kV lines, connecting the power plant groups of Western Switzerland with those of the South and East, consist of steel-reinforced aluminium cables or of cables of pure aluminium and aldrey.

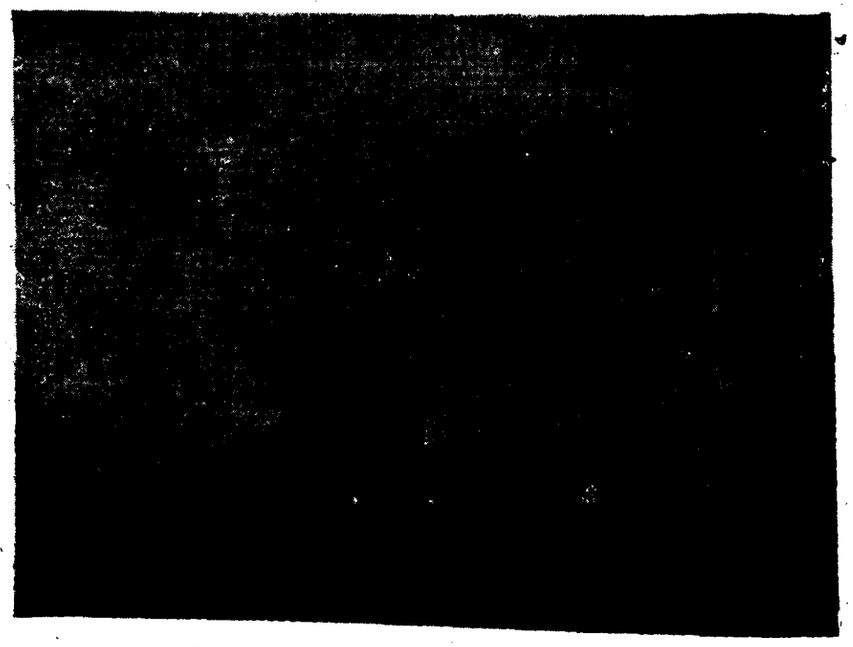
The photographs illustrate several types of construction of the masts and of the arrangement of the conductors, such as were erected by the Zurich Company of Kummler & Matter. The connexion of these lines with the high voltage collecting rail of the sub-station is effected over high-tension switches.

THE CONTACT LINE

The contact line constitutes a very essential component of electrical locomotion, as it must feed electric current to the locomotive without sparking, even at high speeds of 100 m. p. h. and more. Interruption, i. e., sparking injures the driving engines of the locomotive, as well as the line itself. The problems relating to statics and dynamics in connexion with the contact line were thoroughly examined and put to practical use in theoretical and practical tests based on their many years' experience by Messrs.

Kummler & Matter, the firm which erected a great number of the Swiss contact lines. The 15,000 V-winding of the transformers is insulated against the earth and connected with the contact line over the transmission line with which it is interconnected by the already mentioned feeding point switches. The other pole leads directly to the rail network. The tracks, i. e., the rails connected by bonds are, therefore, part of the electric circuit. The insulated parts of the contact line conduct the full tension of 15,000 V to the rails, the earth and the suspension constructions all over. The whole contact line network of the SBB is divided into line sections in such a manner that several of the latter are connected with one feeder line each to a sub-station. Several such contact line sections with the corresponding sub-stations and transmission lines are grouped together to form greater units of the total network, thus constituting important consumption centres of the energy supply to the power plants, and are electrically insulated from one another by so-called "protective" stretches.

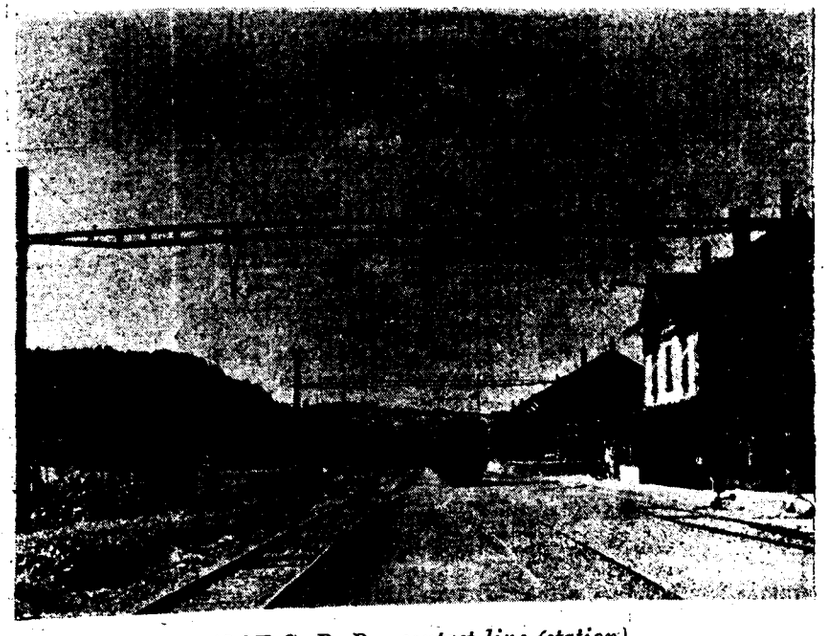
The stations are electrically separate from the free stretches and are bridged over by connexion lines. The span or distance between two suspension points measures from 165–200 ft. on the SBB. The contact wire is a grooved copper wire with a cross section of 107 mm²0·166 sq. in. and is vertically suspended from a galvanized steel catenary rope with a cross section of 50 mm² 0.0775 sq. in. by from 4 to 6 hangers per span. At the suspension points, the contact wire is held from the side by insulated pullovers. In order to avoid hard points in the contact lines, the pullovers are made of light-weight steel tubing, and their insulation



15 kV S. B. B.—contact line (straight line)
Erected by: Kummler & Matter, Zurich

15 kV High speed, full elastic, warped contact line

15 kV S. B. B.—contact line (curve)

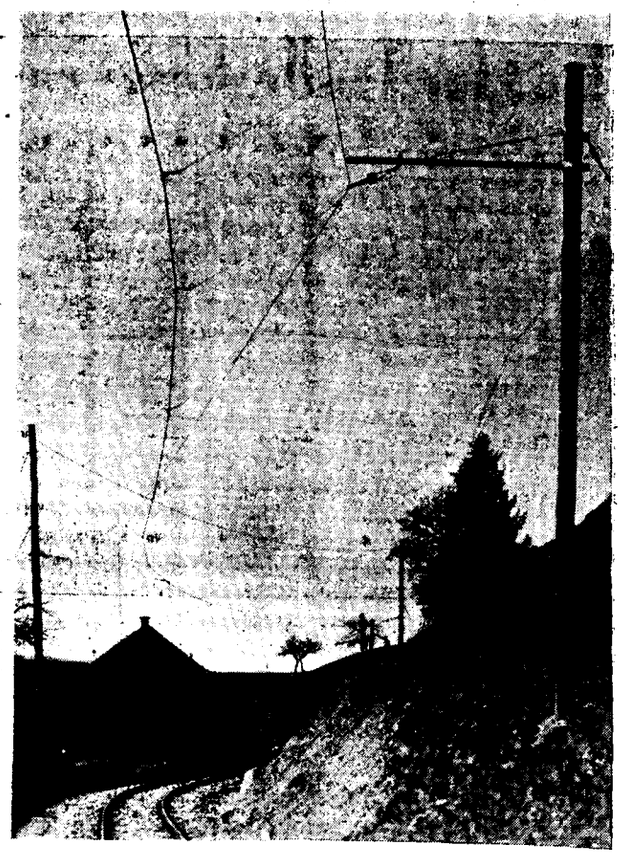


15 kV S. B. B.– contact line (station)

is fastened to the masts (cf. illust.). These pullovers hold the contact wire in a slightly zig-zag line above the axis of the tracks, so that the pantograph is uniformly worn. There have been no essential changes in the principles of erecting the contact lines thus

far, but the latter have been so improved by the use of lighter clamps and pullovers and by the most advantageous placing of the hangers that current is constantly fed, even at great running speeds.

In order to keep the suspension tension of the contact wire constant at all temperatures, summer and winter, the contact wire is stretched from both sides by weights of 600–800 kg. approximately 0·9 m. apart from one another. This is necessary in Switzerland on account of the great fluctuations in the temperature.



750 V High speed, full elastic, warped contact line (curve)

For especially high demands and speeds, Kummler and Matter have developed a new full-elastic warped contact line which may be regarded as the best and most modern design in this field, the contact wire hardly being worn at all any more, and every contact interruption and disturbance being prevented.

The performance of electric railways has lead or is leading to the electrification of railroads in most countries. Further reasons are the rising price of coal, at present due to the war effort, and to no less great an extent to the favourable experiences made by those countries who pioneered in the introduction of electric railway traction. Among these, Switzerland with her totally electrified State Railways has justified claim to the first rank.

Remarks: BBC = abbr. Brown, Boveri and Co., Ltd., Baden.
MFO = abbr. Maschinenfabrik Oerlikon.
SLM = abbr. Schweizerische Locomotiv—and Maschinenfabrik, Winterthur.
K&M = abbr. Kummler and Matter, Zurich.
SBB = abbr. Schweizerische Bundesbahnen, all in Switzerland.

The Fully Elastic Overhead Contact Line for Trolleybuses and Trams

Generally speaking, the construction of overhead contact lines for trams and trolleybuses is a little noticed technical field. Vehicles are built for high or low speeds, similarly there are "slow and quick" overhead contact lines. The quality of the overhead contact line depends on the uninterrupted receipt of electric current. The static and dynamic problems which result from this are here discussed and explained. By comparing the old, rigid overhead contact line with the new, modern, fully elastic one, suspended on slanting pendulums, the efforts of the builders of these lines are explained.

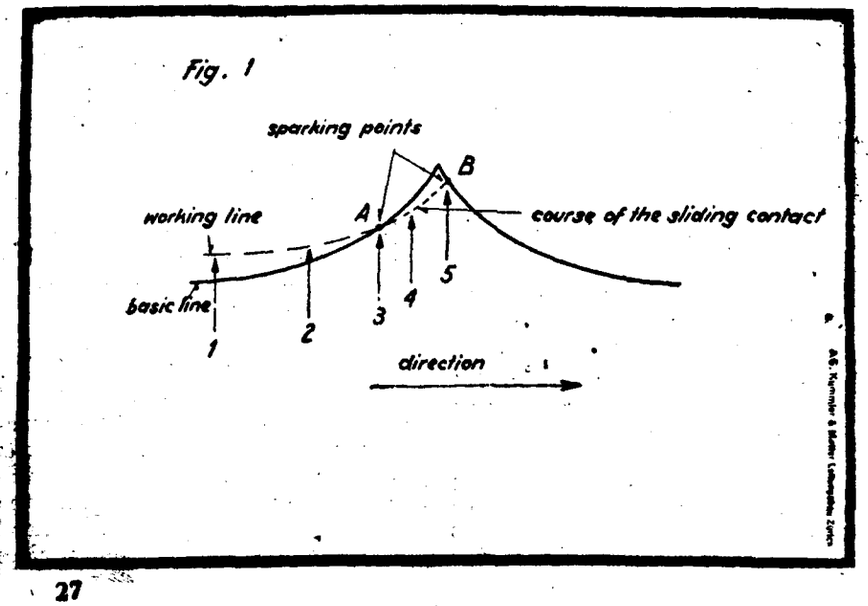
THE technical progress and perfection of the means of urban transport, such as the tramway and trolleybus, have considerably heightened the travelling and maximum speeds. The increase in speed has made the means of transport more economical. It is, therefore, in the interest of a transport organisation to attain the greatest possible speeds.

Most of the overhead contact lines of urban transport have not kept pace with this development and often consist of the simple, rigid suspension, although this is inadequate for present day use. The old, rigid overhead contact line not only causes greater wear and tear but also extensive sparking at high speeds which, in turn, produces radio distrubances. In the case of trolleybuses dewirements of the current receiver is a frequent result.

More than 10 years ago Messrs. Kummler & Matter of Zurich, developed a fully elastic overhead contact line which meets the requirements of quick travelling for electric vehicles and excludes the disadvantages of the old, rigid suspension.

(A) STRAIGHT LINE

RIGID OVERHEAD CONTACT LINE



In the following paragraphs the most important occurrences connected with the receipt of current are to be explained as well as the difference between the rigid and fully elastic overhead contact line.

If a contact wire is suspended at two points it produces an approximately parabolic line. In the middle, between the two points of suspension, the line is horizontal and then climbs on either side towards these points at an increasing angle. The deviation from the horizontal is, therefore, greatest in the immediate vicinity of the suspension points. This ascent of the contact wire depends on the distance between the suspension points and the specific tension of the wire.

If a trolley shoe or pantograph slides along the wire, the pressure of this sliding contact displaces the wire from its basic position into its so-called working position. The displacement between the basic position and the working position is greatest in the middle of the span, smallest at the suspension points. It depends on:

1. The pressure of the sliding contact
2. The length of the span
3. The specific tension of the contact wire
4. The profile of the contact wire
5. The speed of the vehicle, i. e., the sliding contact

The curve of the working position is of the same order as that of the basic position, i. e., horizontal in the middle of the span, steepest at the suspension points.

If the contact slides along the working line (Fig. 1) its course between point 1 and 2 is practically horizontal. When the sliding contact is about to reach point 3, it must be accelerated upward corresponding to the steepness of the wire curve. The possibility of accelerating the current receiver or the trolley shoe is limited by the mass *inertia* and the pressure of the receiver. In other words, the sliding contact can no longer follow the constantly steeper curve of the wire with increasing speeds and accordingly jumps off the contact wire at A, hops over the suspension point and rejoins the contact wire at B of the next span. This jump is very easily recognized on the old, rigid overhead contact line by the sparks shortly before and after the suspension point.

This jump is further favoured by the wave of the contact wire which is produced by the current receiver's pressure. This wave is reflected on the rigid suspension point and helps to hurl the current receiver downwards.

Besides radio disturbances, the jump produces welding pearls at *A* and *B*, and furthermore, extensive wear of the contact wire at *B*.

This welding, in turn, has a destructive influence on the sliding contact. The positions of *A* and *B* change depending on the above-mentioned points 1–5.

The jump of the contact can be diminished by an increase in the contact pressure, which, however, augments the wear and tear of the contact wire and the sliding contact carbon.

THE ELASTIC OVERHEAD CONTACT LINE

It has been the object of exhaustive research of Messrs. Kummler & Matter Ltd., Zurich, during the past ten years to overcome the disadvantages of the rigid overhead contact line and to ensure perfect

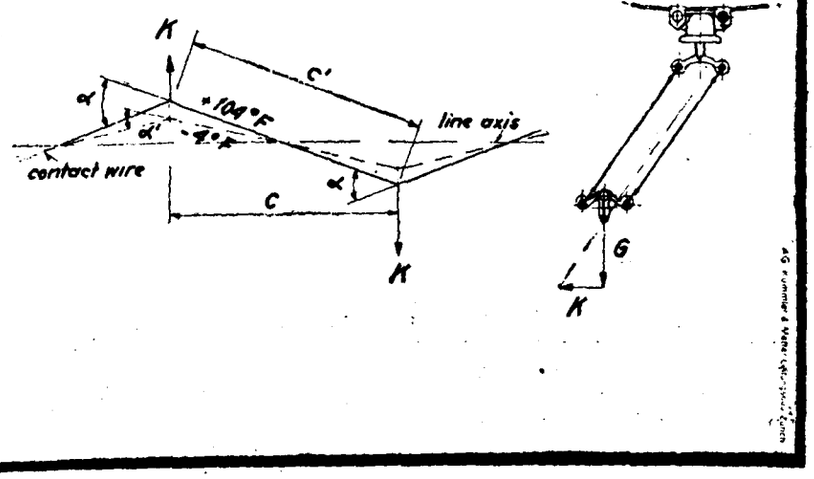
receipt of current, also at the suspension points, without the usual wear and tear on the contact wire and the sliding contact.

The suspension point of the contact wire had, therefore, to be elastic in order to obtain a constant contact pressure along the whole line.

From several possibilities to hang the contact wire elastically, the slanting pendulum was chosen as it embodies all the elastic means of suspension with the following advantages:

1. Equal pressure of the current receiver because of the give of the contact wire at the suspension points.
2. Immediate muffling of the oscillations.
3. Through this high working security no danger of dewirements.
4. No radio disturbances.
5. Maximum duration of life of the sliding contact carbon parts on the current receiver, without the necessity of oiling the lines.
6. Practically no wear and tear on the contact wire, long life, small pressure.
7. Part compensation of the thermic expansion of the contact wire, i.e., the tension difference.
8. Possibility of maximum span up to 44 yards on the straight fewer suspension poles.
9. Small expenses for the upkeep and, therefore, economical.
10. Possibility of the high speeds even in curves, without the driver having to consider the contact line. Through this, higher travelling speeds and saving in operation expenses.

Fig. 2



If a contact wire is laid along a straight axis in zig-zag, (max. angle of the contact wire on the straight 2½°) it results in two components at the suspension point: The one is weight *G*, depending on the span, the other the horizontal pull *K*, depending on

Fig. 3

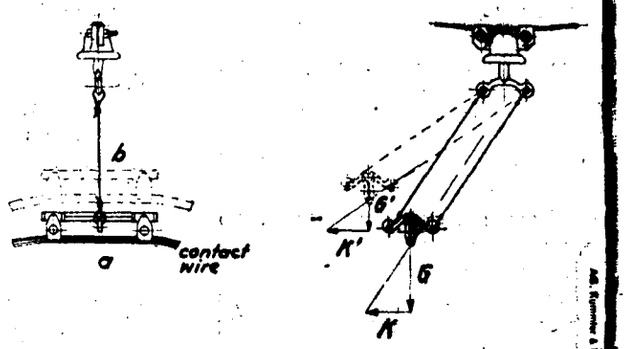
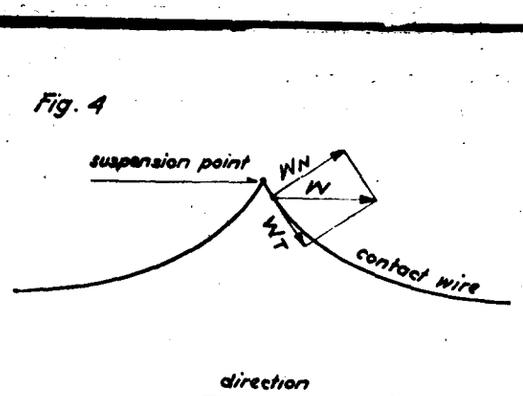


Fig. 4



the angle α. If the contact wire is hung up on the suspension point by a pendulum, as shown in figure 2, these two components give as a result a certain obliquity of the pendulum.

It is now important to note the following:

If the vertical component is changed even very slightly, by the pressure of the sliding contact, the obliquity of the pendulum is changed immediately and as a result the height of the contact wire at the suspension point.

If the sliding contact moves towards the suspension point, the pressure of the current receiver or the trolley shoe, respectively, bears a larger part of the weight

of the contact wire the more it approaches the suspension point, i. e., the vertical weight component on the pendulum is reduced, its obliquity becomes bigger and the contact wire according to figure 3 is pushed from position *A* to position *B*. Upon reaching the immediate vicinity of the suspension point the ascent of the wire is steepest. To remain in contact with the wire, the trolley shoe would now have to accelerate upwards considerably which, due to its mass *inertia*, is impossible at higher speeds. With the rigid contact wire the jump previously described would now occur.

In order to permit the contact to leave the wire, the pressure would previously have to drop to zero. However, if the pressure drops, the vertical component on the pendulum increases, i. e., then pendulum is getting steeper and the wire drops (Fig. 3). Should the sliding contact not be able to overcome the ascent of the wire before the suspension point, the wire which had previously been pushed upward, falls downward to meet the shoe and thus ensures the proper contact.

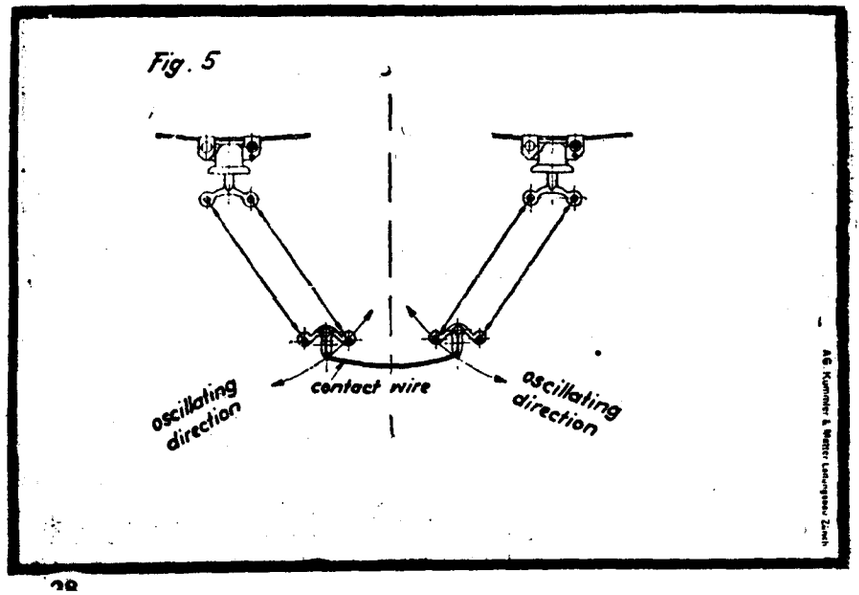
Having passed the suspension point, the sliding contact hits the next span with a certain force *W* which depends on its mass and speed. (Fig. 4). This horizontal force is divided into two components. The one *Wt* is tangential to the contact wire and is, therefore, harmless. The other one *Wn* is vertical to the wire upwards and causes, if the wire is rigidly suspended, considerable wear after the spspension point.

When the wire is elastically suspended, on the other hand, the component *Wn* which is directed upwards, results in a reduction of the vertical component of the pendulum, therefore, the wire rises and absorbs elastically the shock of the sliding contact.

As stated above, this is only possible, however, if the wire is suspended by slanting pendulums. If the pendulums were vertical, the pressure of the current receiver would first have to overcome the entire weight of a span of the contact wire, before the wire yields.

Through the pressure of the sliding contact and through the

Fig. 5



trolleybuses deviations to either left or right, the contact line oscillates.

Figure 5 shows the contact line viewed along the axis. The arrows indicate the direction of the movement or oscillation direction, respectively, of two successive pendulums.

Oscillations of the contact wire do not, as with the rigid type of overhead contact line, reflect

Full elastic suspension of the contact line for Tramway (pantograph) on straight line

on the suspension point (break of the wire through fatigue) but can run all along it.

However, as the directions of movements of two successive pendulums are at an angle of approximately 90°, the oscillations are killed in a very short time.

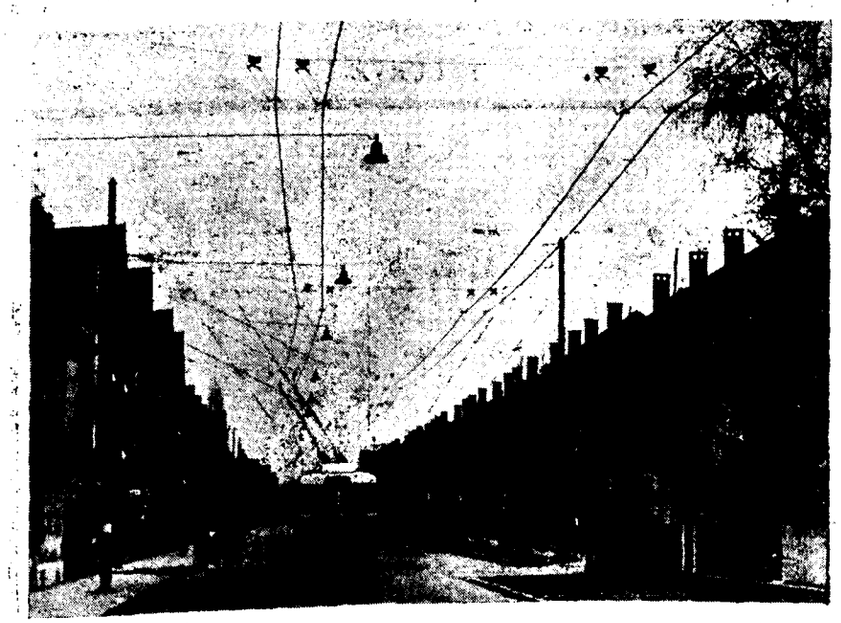
As is clear from the explanations made, the superiority of the elastic suspension over the rigid one lies in permitting vertical oscillation of the suspensions points as a function of the pressure. The contact wire must, therefore, always be vertical in every position of the pendulum. This is achieved by a simple wire parallelogram (Fig. 2). This suspension by the pendulum has a further advantage in the fact that the weight, the mass of the moving parts, respectively, is very small, whereas the heavier insulator is attached to the cross suspension.

The zig-zag method in the span of the contact wire has no disadvantages as the small forces

Slanting pendulum on straight line for Trolleybus

resulting from the horizontal acceleration of the trolley shoe at the suspension point is compensated by the pendulum.

The zig-zag span, in connection with the slanting pendulums, partly compensates the thermic tension changes of the contact wire. This effect is reached because different temperatures change the slant of the pendulums



Full elastic suspension of the contact line for Trolleybus on straight line.

as well as the angle of the contact wire at the suspension point and thereby alter the distance from span *C* to span *C'* (Fig. 2).

To build a trolleybus overhead contact line economically as few suspension points as possible should be used, i. e., the angle of the contact wire at the suspension points must be as large as possible.

To prevent detrimental side-hits of the trolley shoe on the contact wire this angle is rounded off. The head of the contact wire is clamped between two elastic rails, the length of which depends on the angle of the contact wire. These curve rails are attached to the cross suspension by a parallelogram pendulum according to figure 9. Depending on the angle of the curve the curve rails can have one, two or three oscillating pull offs. The curve rails are mounted in such a way that the curve of the contact wire at the suspension point is a parabola. This curve-form ensures the proper augmentation and diminution of the centrifugal powers of the current receiver shoe and eliminates sudden moves to the side which cause dewirements.

GENERAL CONCLUSIONS

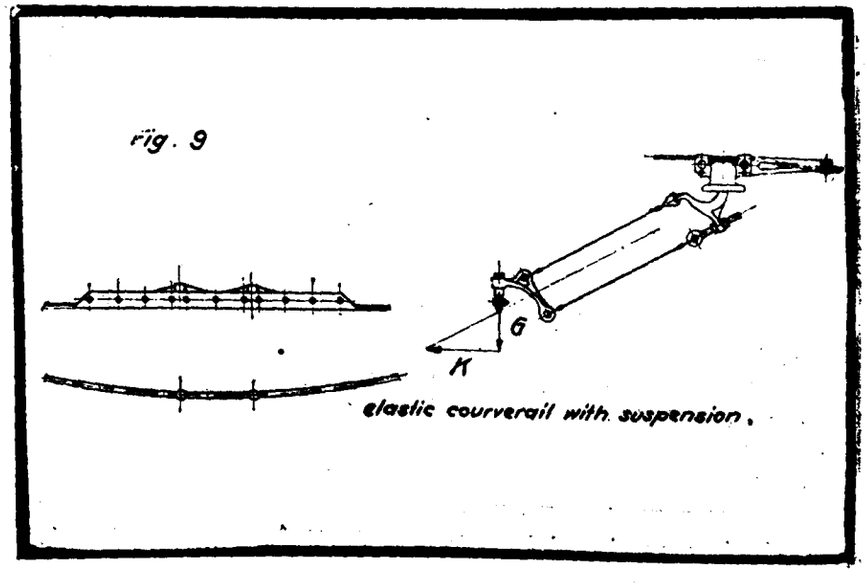
Comparison between the rigid and elastic trolleybus overhead contact lines has shown that dewirements are fewer with the elastic type than with the rigid.

On the straight and in curves considerably greater speeds are possible with the elastic system.

In view of the explained technical advantage of the elastic system, the life of the sliding contact carbon is considerably longer. This lifetime varies in the different plants and also with the time of year, but sliding contact carbons have been known to last for 14,000 km.

Control of a contact wire after approximately 10 years with 500,000 whettings showed that the change in the diameter of the contact wire was still within the limit of the tolerated manufacturing deficiencies; wear and tear was, therefore, not ascertainable.

(B) CURVE



Full elastic suspension of the contact line for Tramway (pantograph) in curves

Full elastic suspension of the contact line for Trolleybus in curves

Changes of train overhead contact lines from the rigid to the fully elastic system were subsidized by the Swiss Post office Department (PTT) because it does not cause radio disturbances.

(Continued on next page, bottom)

Precision Ball Bearing Manufacture in India

The First Undertaking of its Kind in Asia

THE recent world war emphasised the important role which anti friction bearings play in engineering industries of all countries.

It was because of the growing need for such an industry in India that Messrs. Birla Brothers undertook the important step, of setting up a plant for the production of ball bearings.

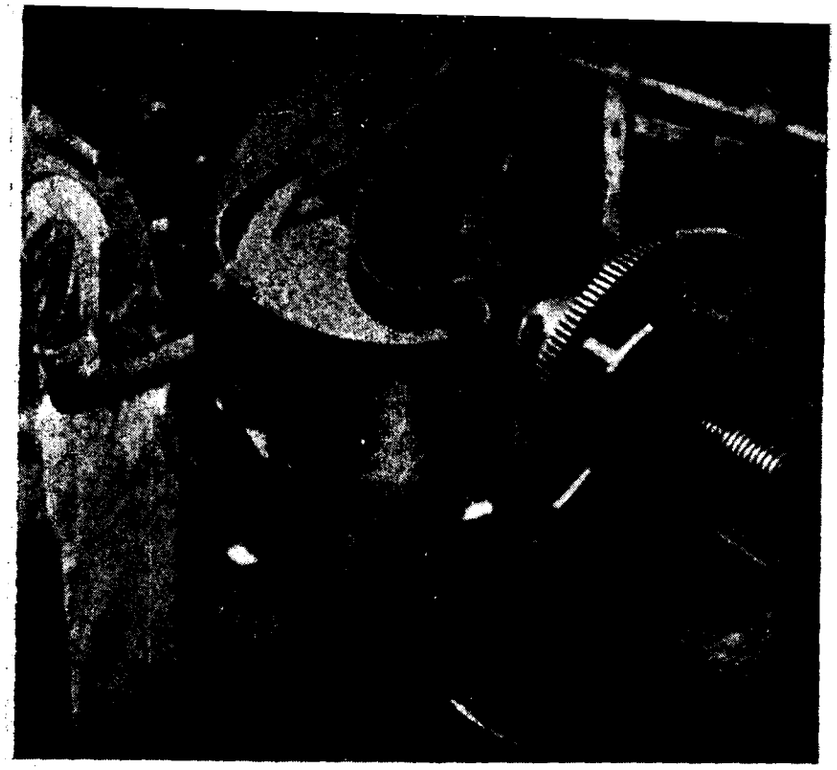
Negotiations were completed in 1947 with Messrs. Hoffmann Manufacturing Company Limited,

Ball Inspection Department Visual examination of all surfaces for surface imperfections and discolouration.

FROGS AND CROSS OVERS FOR TROLLEYBUS OVERHEAD CONTACT LINES

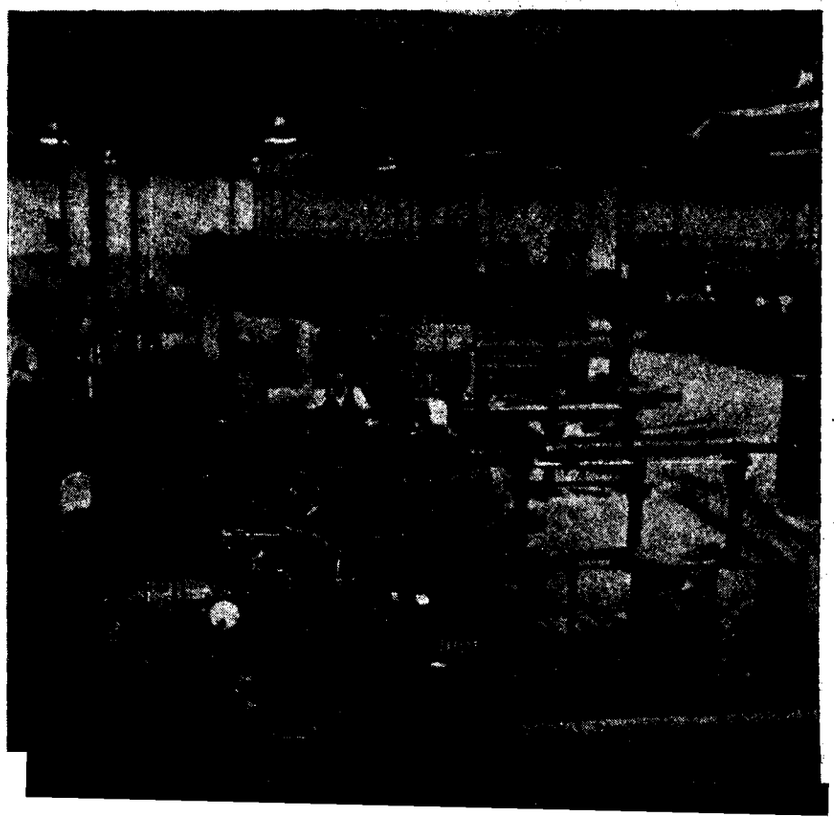
Weak points of most trolleybus overhead contact lines are the frogs and cross overs, which can often only be past at walking pace.

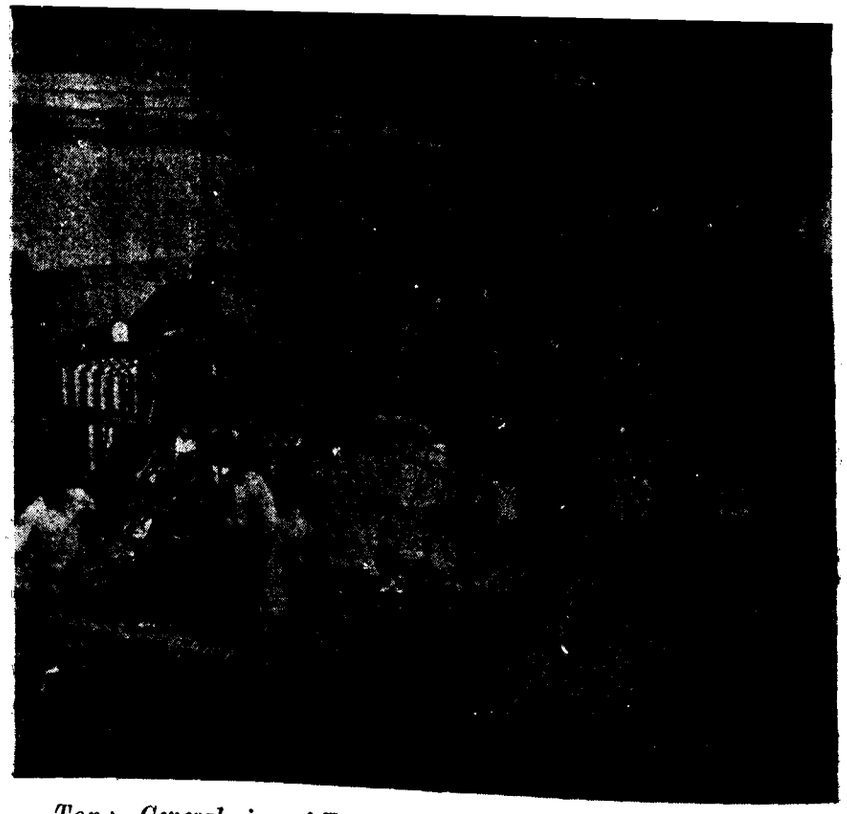
The firm Kummler & Matter Ltd. developed these items so far that the trolleybus need hardly reduce speed at these points.



Top: Balls in process of Grinding

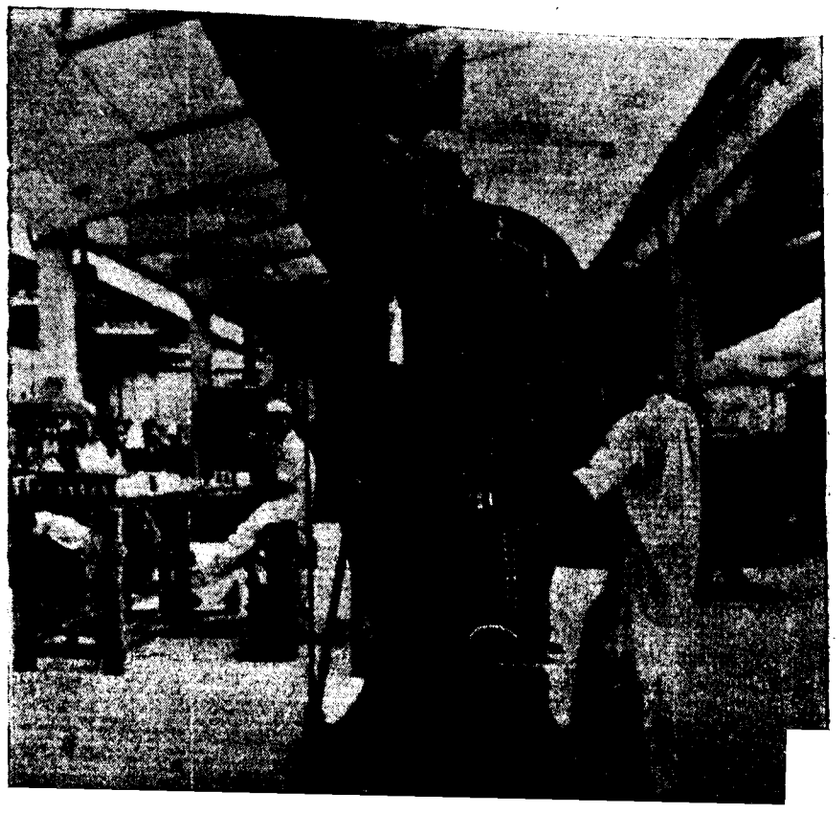
Bottom: General view of Turret Department with 4—Six spindle Autos in foreground





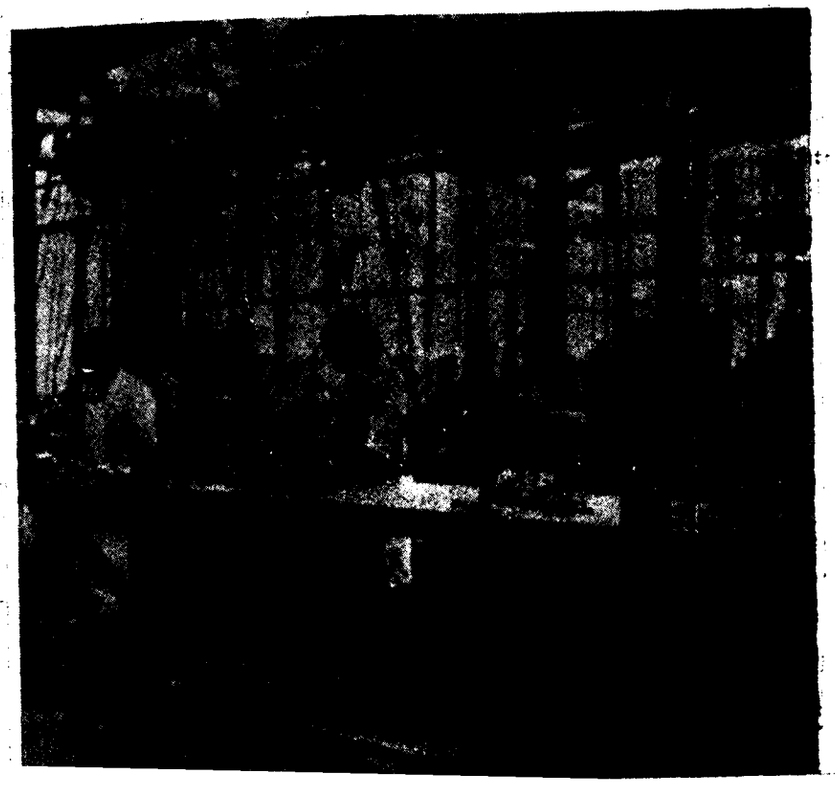
Top: *General view of Turret Department Form heads on left, Fays in foreground*

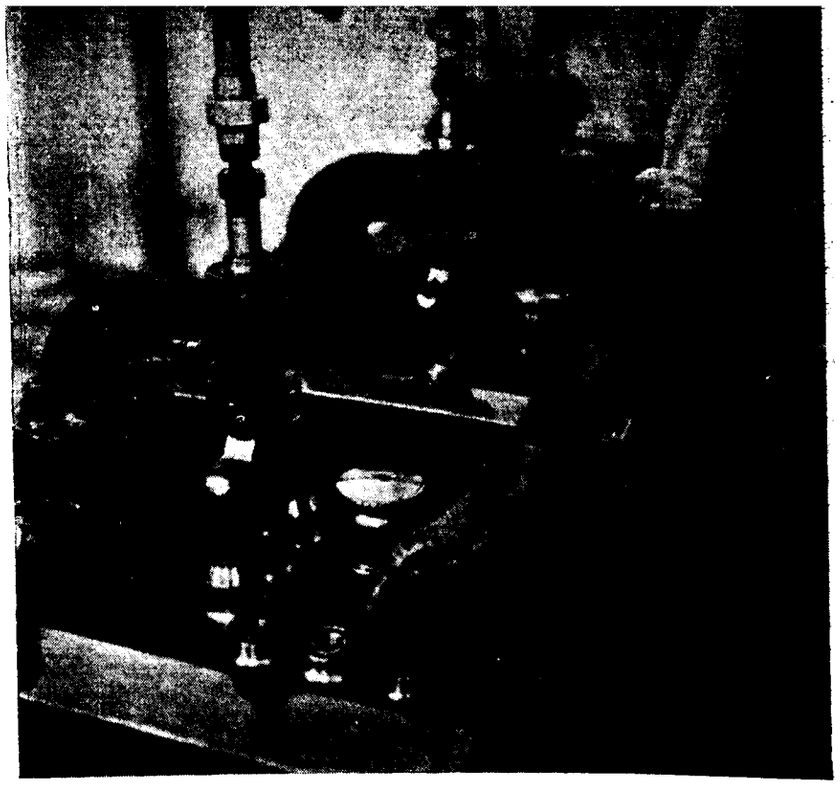
Bottom: *Operation 54. Press Producing Blanks for pressed type cages from Non-Ferrous strip*



Top: *Operation 39. Check Inspection Bench for Sleeves and Nuts in Turret Department.*

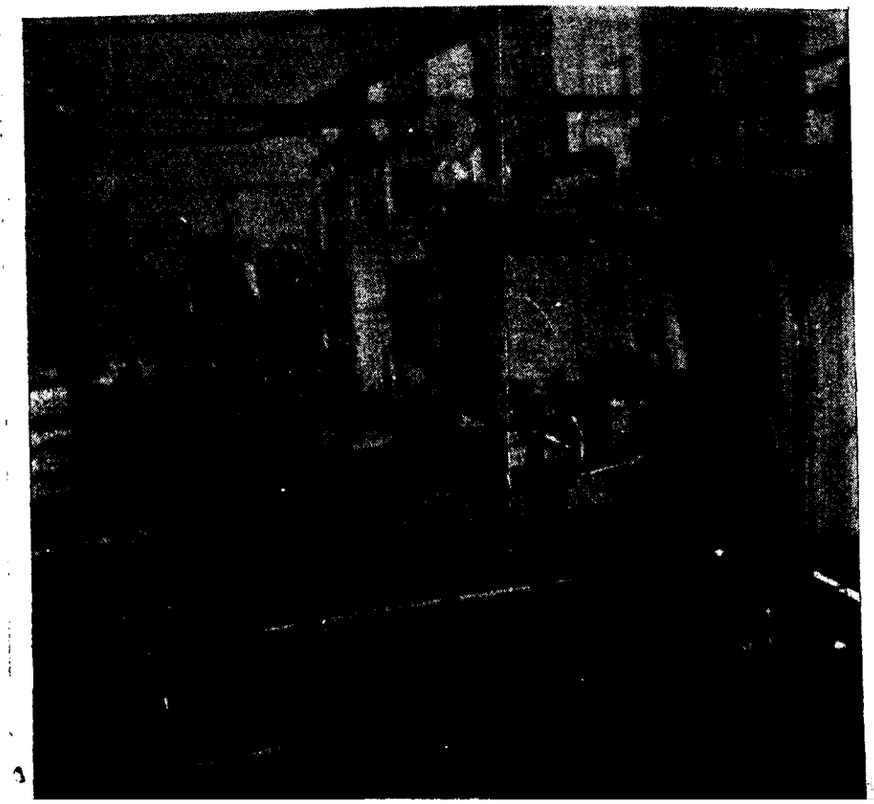
Bottom: *Operation 39. General view of Check Inspection Bench in Grinding Department*

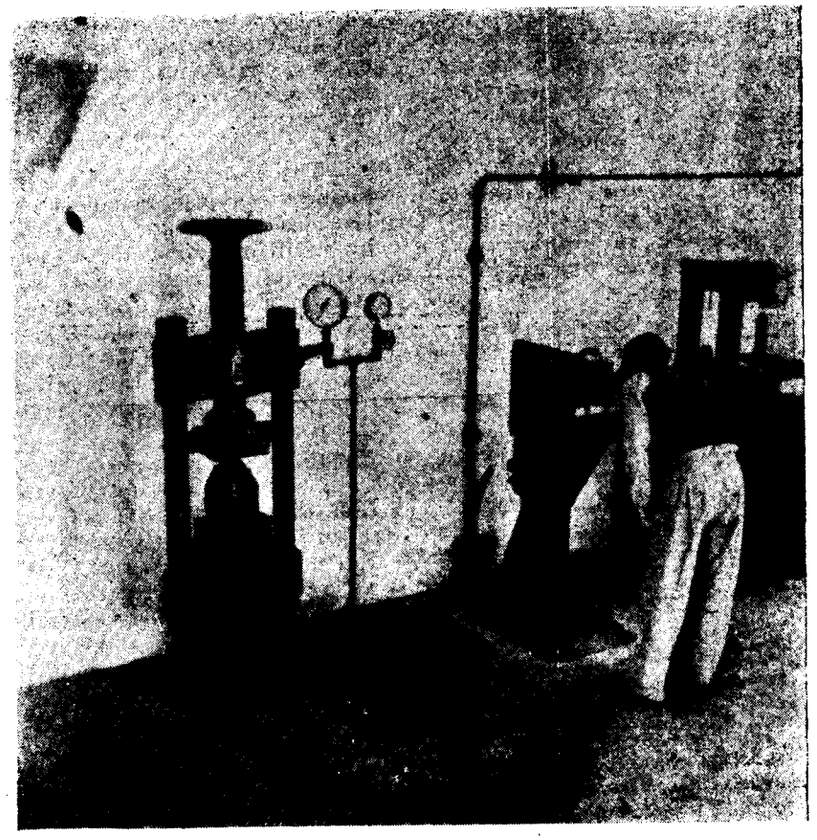




Top: *Operation 58. Finished bearings being washed under high pressure Paraffin Jets which rotate the bearings whilst washing*

Bottom: *Hardening Department showing Special Rotary Gas fired furnaces for Ball annealing and hardening.*





Laboratory with Hydraulic Ball Crushing Machine on the left, and Vickers Hardness Tester on the right

Chelmsford, England, manufactures of ball and roller bearings for over 50 years, for the manufacture under licence in India of Hoffmann Bearings, the Indian products being known as "Hoffmann Licence" bearings.

A company was formed known as National Bearing Company Ltd., and a site was selected at Jaipur, Rajasthan, for the complete factory, which is entirely self-contained and requiring only raw materials for the manufacture of bearings.

The manufacture of precision bearings necessitated a completely dust proof and air conditioned factory incorporating line flow mass production methods, with up-to-date scientific control at all stages.

The Factory now completed and in operation, is of R. C. C. construction throughout, occupying a floor area of 66,600 square feet in the main buildings. All windows have been eliminated and N. light is admitted through glass blocks which provide insulation against outside heat. The air conditioning plant provides fully controlled temperature and humidity, and the air is thoroughly filtered dust etc., by various filtering arrangements including electrostatic filters.

The main sections of the factory comprise ball heading and lapping, turning, grinding, viewing, assembly, final view and packing department, tool room, measuring department, and laboratory all being equipped with the very latest precision equipment for dealing with the high standard of quality and accuracy of workmanship necessary for the production of high grade bearings.

The hardening department, is in a separate building, dust proof and air conditioned, containing special types of electric furnaces also. Hardening and tempering furnaces gas fired from a gas producer. Control of the furnace temperatures is fully automatic by means of kent controlling and recording equipment.

Lighting throughout the factory is by fluorescent lamps and the layout of the machinery and colour scheming is in accordance with the latest industrial practices to ensure maximum benefits to the operators and quality of their work.

The plant is designed to produce all the bearings and steel balls required by industry with a special emphasis on the smaller sizes required in large quantities by specialised industries in India, particularly for Fan, Electric Motor, Centrifugal Pump and Cycle Manufacturers and bearings required for the Automobiles Manufacturers now producing vehicles in India.

The layout of the plant is arranged for rapid expansion of any section to accommodate increased production, and many of the existing machines and processes have reserve capacity in hand for this purpose.

The high degree of accuracy required in the manufacture of bearings of high quality is ensured by rigid inspection and laboratory testing of all raw materials which are supplied to an exacting physical and chemical specification, laid down by Hoffmann Manufacturing Co. Ltd., based on their unrivalled experience of the requirements in this respect.

National Bearing Company Ltd., has secured the services of seven European experts from Hoffmann Manufacturing Co. Ltd., to supervise each department and stage of production, as well as advising customers on the application and design of equipment to obtain the most satisfactory performance from the bearings. In addition six selected highly qualified Indian Engineer students were trained at the Hoffmann Bearings Factory in Chelmsford, England, and further Indian Engineers are receiving their training in India.

National Bearing Company Ltd., can safely be described as the "First of its kind in Asia" and will provide that much needed link, in the chain of development of Indian industrialisation, which aims at freedom from dependance on other countries for the supply of vital engineering stores and equipment.

Death is at any time blessed, but it is twice blessed for a warrior who dies for his cause, i.e., truth. Death is no fiend, he is the truest of friends. He delivers us from agony. He helps us against ourselves. He ever gives us new chances, new hopes. He is like sleep a sweet restorer. Yet it is customary to mourn when a friend dies. The custom has no operation when the death is that of a martyr.—M. K. GANDHI.

The Indian Railways:

Locomotive Manufacturing Works, Chittaranjan

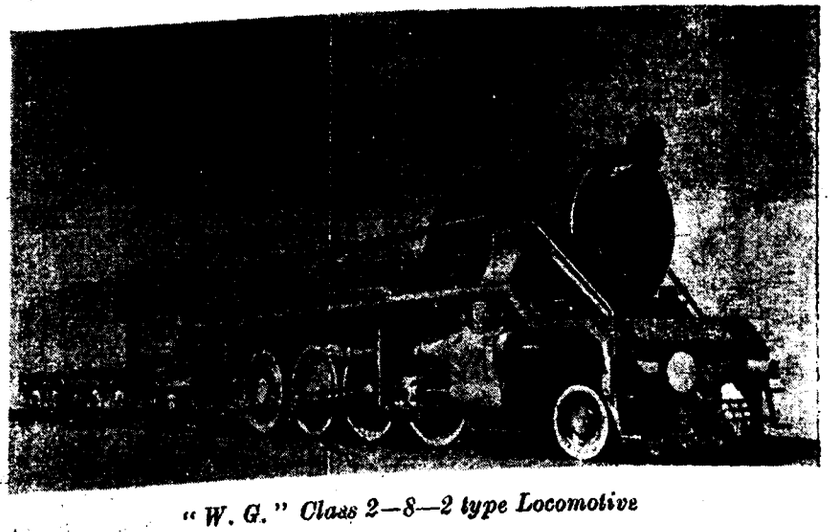
ON the 26th January 1950, Srimati Basanti Devi, widow of Deshbandhu Chittaranjan Das, performed the opening ceremony of the Indian Railways Manufacturing Workshops This large and extensive manufacturing unit was planned and built to make India self-sufficient in the most important single unit of her transport requirements - locomtives. The target production figure for these workshops by the end of the year 1956 is 120 steam locomotives and 50 spare boilers annually for the Indian Railways. When working to full production capacity these shops are expected to be the largest manufacturing unit of its kind in the whole of Asia.

SITE AND LOCATION

Mihijam, a station on the East Indian Railway, 132 miles from Calcutta, and 22 from Asansol, was until recently, little more than a wayside station. In picturesque, undulating country near Mihijam, the site for the Indian Railways Locomotive workshops and colony was chosen, and the station re-christened 'Chittaranjan,' in memory of one of India's greatest patriots—Deshbandhu Chittaranjan Das.

HISTORY OF THE PROJECT

As far back as the 1920's certain far-sighted individuals realised the necessity of establishing a workshop in India so that she could build her own locomotives, rather than rely entirely on importing these from foreign countries. The question was taken up by expert committees, culminating in the Humphreys-Srinivasan report issued on the outbreak of the recent war, which recommended that the old Bengal Assam Railway repair shops at Kanchrapara should be converted into a manufacturing workshop. The outbreak of World War II prevented the scheme being adopted. and for the next six years. India had to face a desperate situation in keeping her locomotives running efficiently by importing components and spares with great difficulty from abroad. This situation emphasised the urgency of India in having her



"W. G." Class 2—8—2 type Locomotive

A view of the site before construction started

Chittaranjan—a panoramic view.

own locomotive manufacturing shops. After the war, Kanchrapara was again selected for the siting of these shops, but due to certain technical difficulties, this was abandoned, and Chandmari, near Kanchrapara, was next chosen. Work was commenced on the new site, but had to be stopped due to new and unforseen circumstances—the partition of the country in August 1947. A fresh survey was then undertaken as a result of which Chittaranjan was given the honour, for several practical reasons—it was close to sources of power, being only 10 miles from West Bengal's rich coal belt, and

The Pattern Shop

6 miles from the site of the proposed Maithon Dam of the Damodar Valley Corporation, from where hydro-electric energy will be obtained. The Maithon Reservoir will also provide an abundant water supply for the thousands who will live and work in Chittaranjan.

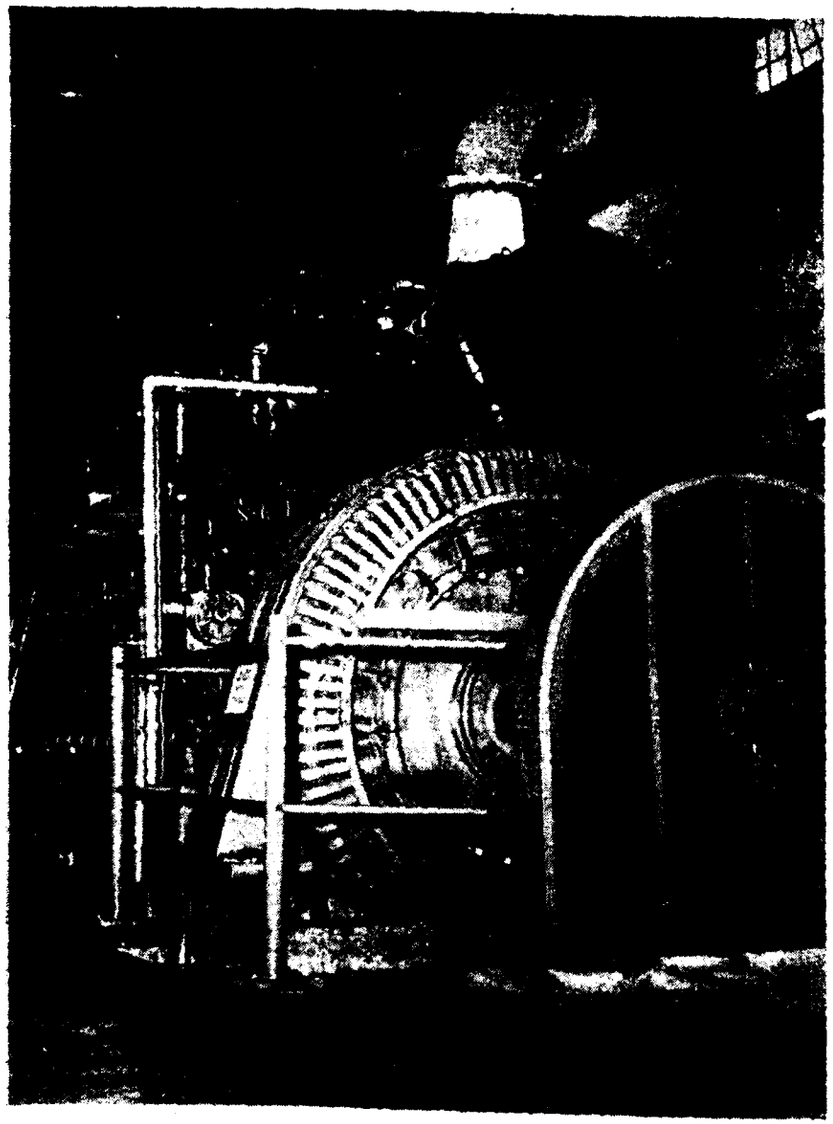
CONSTRUCTION

After six months of intense survey work and planning, the final layouts of the shops and colonies were ready by the middle of April 1948, and simultaneous construction of the workshops with the building of the township and ancillary services required for those who are to live and work in Chittaranjan, were commenced.

WORKSHOPS

Before the erection of the shops could be commenced, the ridge chosen for the site had to be levelled down, and with the help of special machinery 20 million cubic feet of earth had to be moved. 11,000 tons of steel then had to be used for the structural works of the shops. The foundations for the structures and the machines required 355,000 and 120,000 cubic feet of cement concrete respectively. The covered area of all the shops, together with its administrative offices covers over a million square feet. The shops are of steel construction with corrugated asbestos roofing and cloaking with north lighting.

The shops are located in three groups—the South consisting of the Pattern shop, and Iron and Brass Foundries, the Centre comprising the Smithy and Forge, Heavy and Light Machine Shops, and the North with the Boiler, Erecting and Tender shops. The



The Main Generator

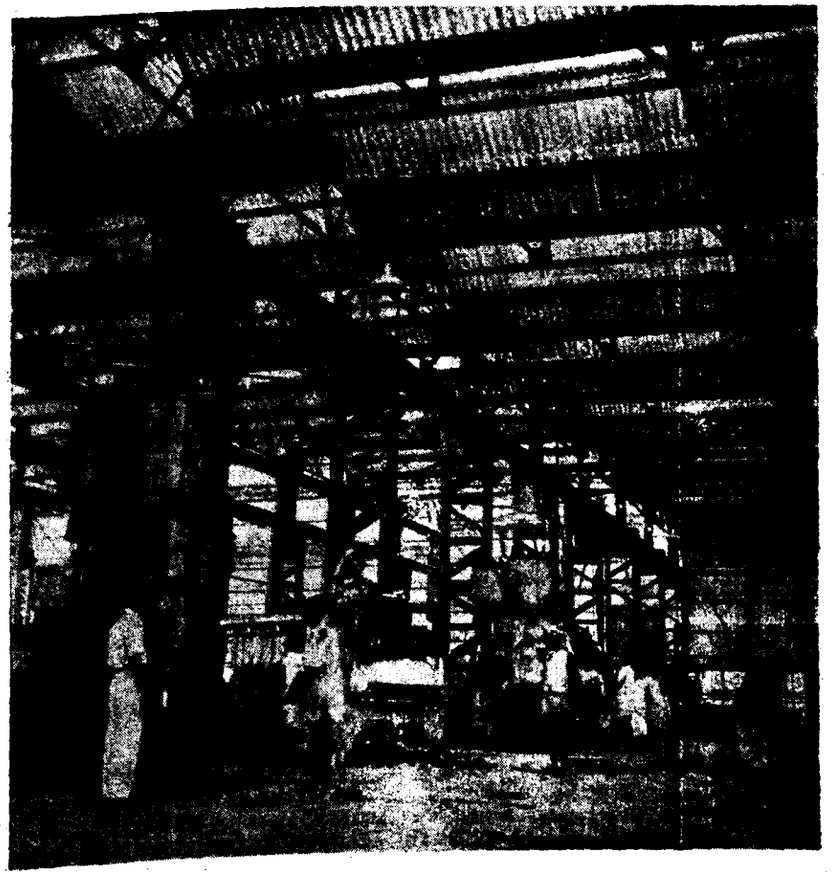
layout has been planned East-West, and in such a way that the raw materials will enter the works at the West end and the finished product will come out at the East end.

The entire shops have been equipped with machinery and plant that are of the latest design and of well known makes, and the machines and fitting area have been so arranged as to permit of a uniflow movement of material.

TOWNSHIP

Chittaranjan has been planned as a model town to accommodate more than 5000 workers consisting of supervisory and skilled staff and about 50% of the unskilled workers,

The Main Assembly Shop



The Smithy and Forge Shop

Sri P. C. Mukerjee, General Manager, speaking at the inaugural ceremony. Shrimathi Basanti Devi is seated on his left

the rest coming from the neighbouring villages. Over 5000 residential quarters occupying about 1000 acres of land will house the inhabitants of Chittaranjan, and every single house will have electricity, filtered water, sanitary lavatory and baths, separate kitchens and water-borne sewage. The colony will have its own shopping centres, maternity clinics, schools, recreation grounds, dispensaries, parks, social amenity centres, recreation institutes, and a well-equipped centrally-situated hospital to provide all medical facilities for all the residents of the town.

POWER SUPPLY

Until the Damodar Valley Corporation can supply hydro-electric energy, the power supply of the shops is being met with a thermal stand-by power station. The central station supplies the bulk of the power requirements, while the smaller units provide power at isolated points for construction purposes. 8 miles of high-tension overhead wires provides the supply of electricity for the township, and about 63 miles of low tension overhead lines will distribute electricity for the fans and lights in over 5000 houses.

MANPOWER

Efficient production depends on adequate manpower. Ultimately about 2000 skilled artisans, augmented by an equal number consisting of supervisors, semi-skilled and unskilled labour will be required. Manpower is at present being provided by drawing on a nucleus of experienced men from railway workshops, and from the open market through the various Employment Exchanges throughout the country. Employment in these works is also being found for displaced persons, with the requisite knowledge and skill, from East Bengal.

PRODUCTION PLANS

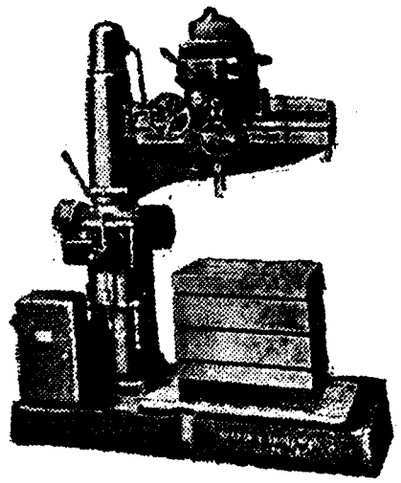
The production of 120 steam locomotives, 50 spare boilers, plus a considerable quantity of loco components and spares per annum is the ultimate target, and given all favourable conditions, by the end of the year 1954 there is every hope that a number of the locomotives hauling our railway trains can be styled as having been completely 'Made in India.'

CONCLUSION

In 1948 Mihijam was an uninteresting, almost sleepy little wayside station, and in April 1951, a little over two years, the Indian Railways Locomotive Manufacturing Workshops, Chittaranjan, are a national institution, humming with power and activity, producing gradually, but surely, the motive power units—the locomotives—that will be hauling the passenger and goods trains transporting India's enormous traffic from North to South and East to West.

"The Assam Rail Link Project"

ON 15th August 1947, when the sub-continent of India was split up into India and Pakistan, the Railways in India were also divided. In the North-west, where Western Pakistan came into being, the division of the Railways did not pose any special problems other than the re-orientation of traffic and the formation of a new Railway system. But in the East it was another matter. The formation of Eastern Pakistan practically isolated Assam from the Northern districts of Bengal falling in India, except for a narrow strip of 12 miles between Pakistan and Nepal at the junction of the provinces of Bihar and Bengal. This meant that the only access between Assam and the rest of India—except through Pakistan—was a short stretch of 2 ft. gauge Railway owned by the then D. H. Railway Extensions Co. Ltd., with an extremely limited capacity for the movement of any kind of traffic. For political, strategic and commercial reasons it was not only essential, but vital, that there should be a direct Rail connection between Assam and the rest of India. The Government of India therefore decided to construct this



Improved 3 Ft. Radial Drill

This machine is of the low base type and has a capacity of 1 in. in steel. It can be supplied with either an accurately machined standard box table or with a swivel table, as desired.

The outstanding feature of the machine is the rigidity of the arm, which is capable of withstanding the heavy stresses set up when drilling large holes at a high rate of feed. This arm is mounted on a substantial cast iron column which is capable of being moved vertically in an outer cast iron sleeve, in order to adjust the relative height of the arm and the workpiece. The elevating and lowering of this column is carried out by means of a rack and pinion operated either by an electric motor or by hand.

Eight spindle speeds ranging from 96 to 1,455 r. p. m. are available. The automatic feed is engaged by movement of the hand-feed lever whilst disengagement of the automatic feed can be arranged at any pre-determined depth. Three rates of automatic feed are provided and in addition to the normal hand feed, a slow hand feed by means of a hand-wheel is provided.

Reversing of the spindle for tapping, etc., is controlled by a conveniently placed lever. The electrical equipment, which is push-button controlled, is built into a neat cabinet mounted on the base of the machine.

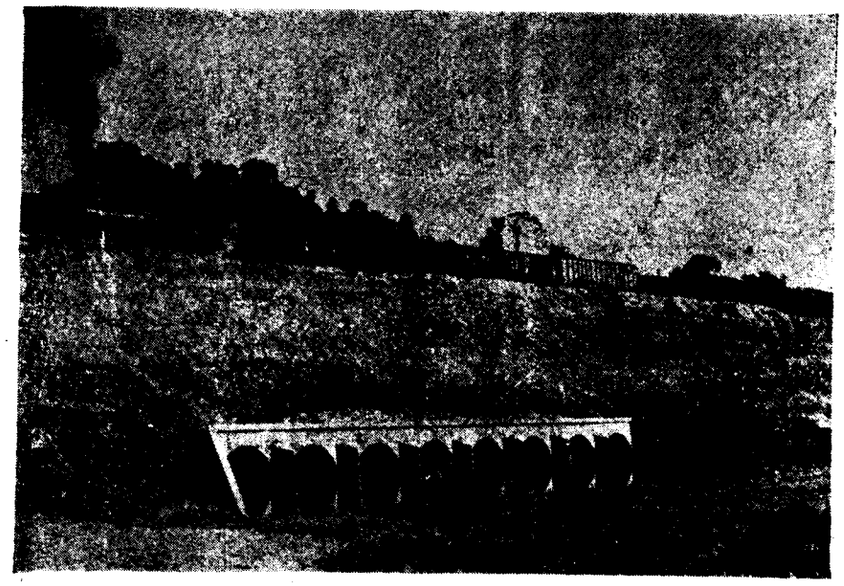
The manufacturers are Adcock and Shipley, Ltd., Ash Street, Leicester, England.

The Tista Bridge. Central Span of 250 ft. Clear with two spans of 150 ft. on each side.

vital Rail Link to fill the gap. Early in November 1947, Mr. Karnail Singh, a senior officer of the Indian Railway Service of Engineers, was appointed to undertake this immense and vital task, which was styled the Assam Rail Link Project. And this is how this Project was born.

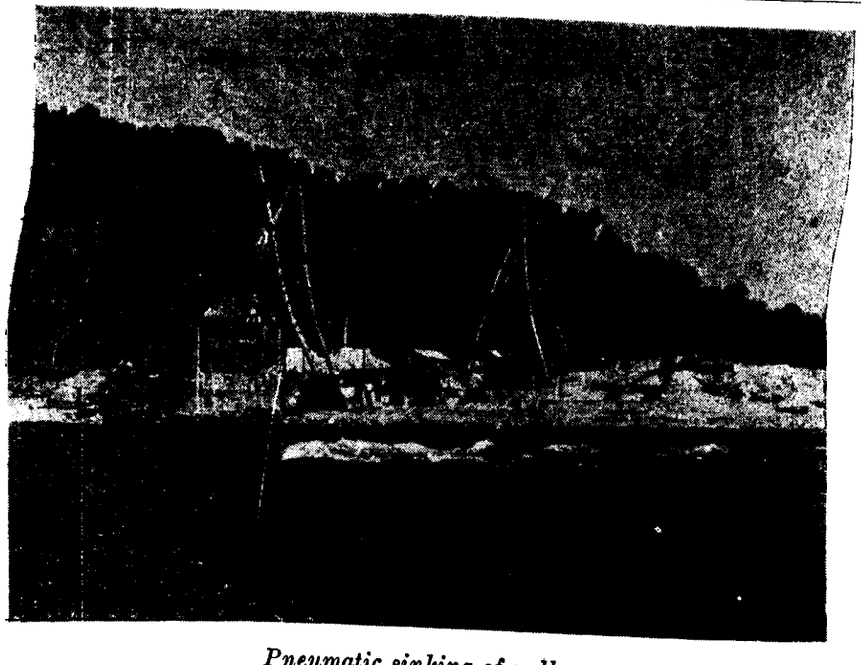
The work started with a rapid air reconnaissance, followed by a return trip on the ground using all conceivable types of transport, as the country to be surveyed and crossed consisted of dense, almost impenetrable forests, swift flowing rivers and streams, and formidable mountains. In the short space of

Through the Sukna Forest



Ten-foot diameter armco pipes at Rongdong

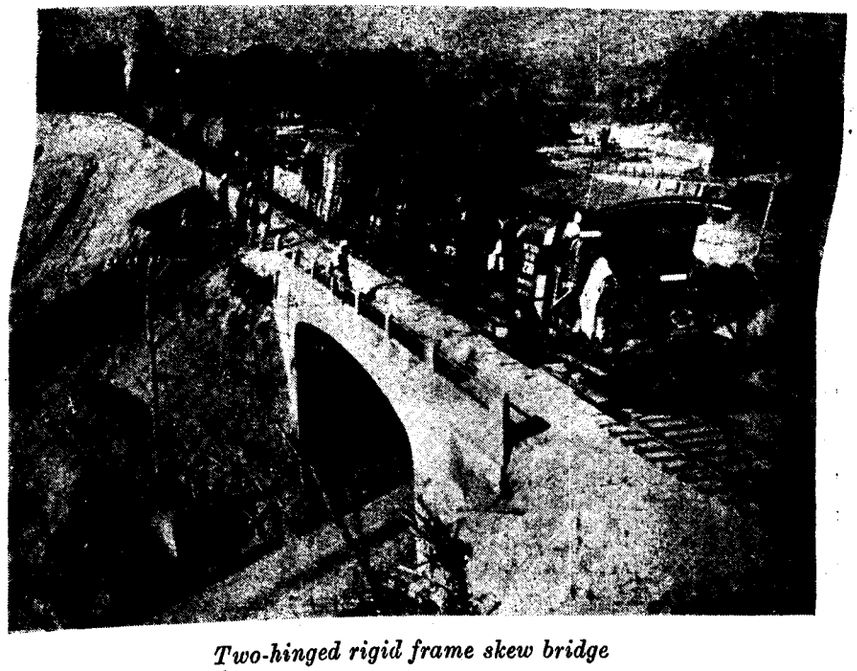
about two months from November 1947 to the middle of January 1948, a mass of data about the proposed location of the Rail link was placed before Mr. K. C. Bakhle, the Chief Commissioner of Railways. A quick tour by the Chief Commissioner, accompanied by the Financial Commissioner, Member Engineering and the Chairman of the Central



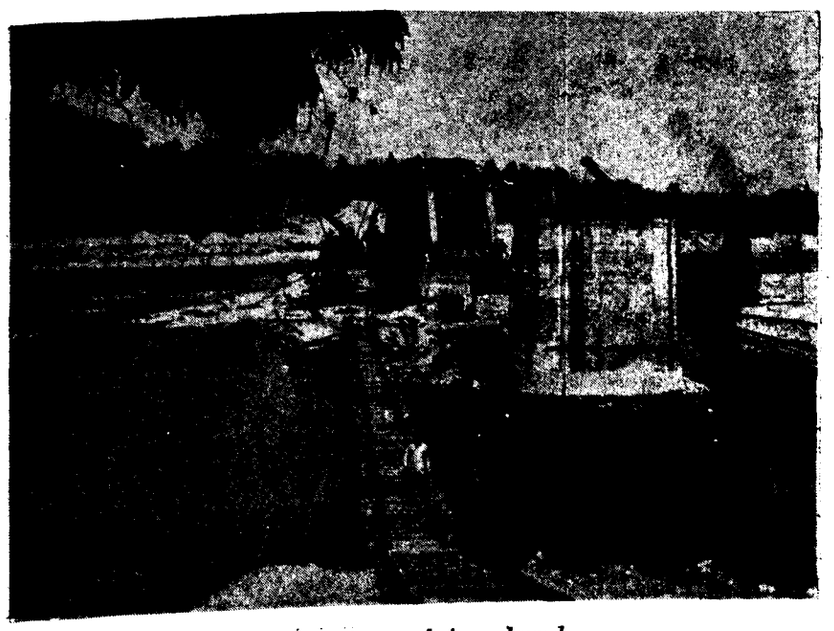
Pneumatic sinking of wells

60 Feet Prestressed concrete spans

Waterpower, Irrigation and Navigation Commission, over the proposed site, crystallised the project, and on the 27th January 1948 the order was given, "get on with the job and get it completed as quick as possible."



Two-hinged rigid frame skew bridge



250 Feet span being slewed

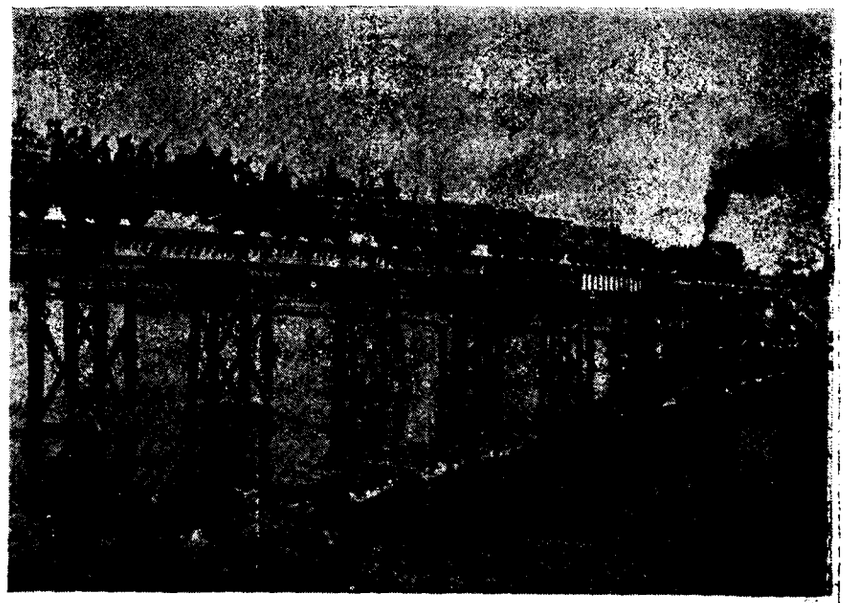
ALIGNMENT, DESCRIPTION OF COUNTRY ETC.

The gauge adopted for this Link was the metre gauge, the same gauge in use both on the O. T. and Assam Railways, which two Railways had to be linked up.

Launching of 150 Feet span

Temporary crib bridge

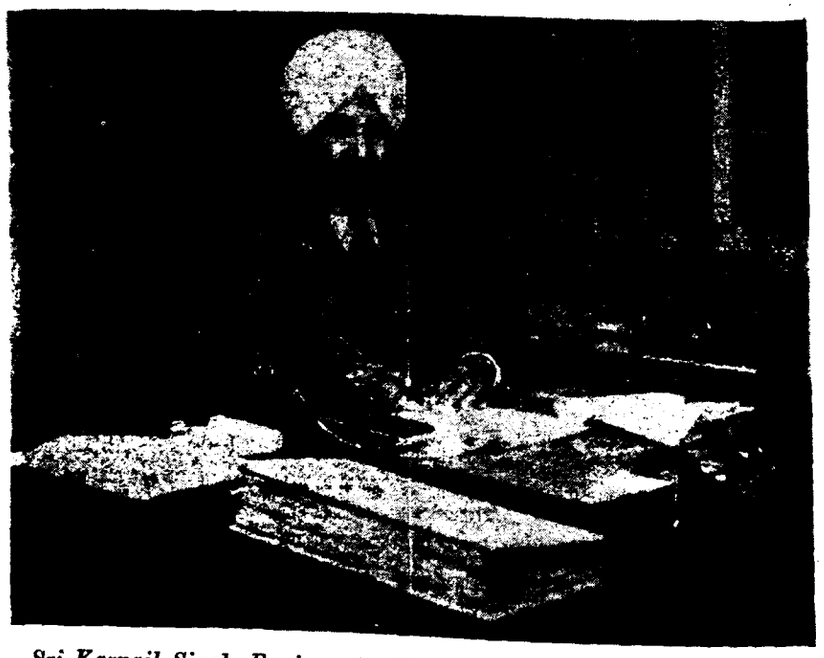
(i) *Kishanganj-Siliguri Section.*—The new link started from Kishanganj, a junction on the O. T. Railway, to Siliguri, 66 miles away. This section was previously linked with a 2 ft. gauge Railway—little more than a tram-line system—which had to be replaced by metre gauge



Pile bridge

Sal bullies carrying track for light loads

tracks. This meant the wholesale renewal of all the existing tracks, bridging, building and other structures. This section runs in a North-easterly direction closely following the Ganges Darjeeling road for a distance of about 20 miles, then deflecting North for 19 miles to the boundary of Bihar at Galgalia. The country traversed



Sri Karnail Singh, Engineer-in-Chief an important Link in the ARLP.

is an alluvial tract yielding rich harvests of rice and jute, but due to the low-lying physical contours, inter-spersed with shallow swamps, stagnant streams and wide stretches of flooded land, it is very malarious. From Galgalia the new line skirts the Nepal border, with a slight bulge to the East, passing through wastes of tall grass and stubby jungle to the meandering bed of the Méchi River. 13 miles from Galgalia the Railway comes to Naksalbari, practically on the Nepal border, then turns due East through typical Terai country, consisting of numerous swift-flowing rivers and streams, and thick jungles, till it comes to Siliguri, a town which has grown considerably in size and importance since partition.

(ii) *Siliguri-Bagrakot Section*—From Siliguri (the terminus of the pre-partition Eastern Bengal Railway and the starting point of the little 2 ft. gauge Darjeeling Himalayan Railway), the new line runs for a distance of 22 miles to Bagrakot, the Western terminus of the old Bengal Dooars Railway. Here the line ran along the foot of the towering Himalayan mountain range, and the most important and difficult problem lay in bridging the swift-flowing, deep-torrented tricky Tista river. But this gigantic task of skilled bridge engineering, entailing heavy earthwork, was accomplished and the tricky Tista river was bridged. In addition to this major problem of bridging the Tista, a total of one hundred bridges spanning smaller rivers and streams on this 22-mile section alone was achieved.

(iii) *Madarihat-Hasimara Section*—From Madarihat, the Eastern terminus of the old B. D. Railway, to Hasimara on the Gitaldaha-Dalsingpara line, is a short stretch of only 8½ miles, and here the main problem was the bridging of the fierce and mighty Torsa river, which had been considered unbridgeable in the past, due to its flood waters suddenly sweeping across the country at velocities over 15 ft. per second, and changing its course frequently.

(iv) *Alipur Duar to Fakiragram Section*—A distance of 45 miles, to by-pass the Pakistan portion of 8 miles near Patwshwari in the Gitaldaha-Amingaon Section. In this stretch of 45 miles, 19 miles in Bengal and 21 miles in Assam, did not present any peculiar difficulties, except for the crossing of numerous streams and rivers. In this section a short length of 5 miles, lying in Cooch Behar State, proved a formidable task due to thick and almost impenetrable forests, and the rivers Sankosh and Raidak, with their numerous tributaries.

ENGINEERING CONSTRUCTIONAL PROBLEMS

(i) *Earthwork*—In order to clear a path for the rail tracks to be put down, about 200 million cubic feet of earth had to be moved in the few months between November 1948 and April 1949, after which the heavy and continual rainfall made this type of work well-nigh impossible. This earthwork had to be done in earth varying from sandy loam, in the alluvial plains, to soil mixed with gravel, shingle and boulders between the deep cuttings and high fills in the Himalayan foothills. All available resources, both manual and mechanical were employed to move this enormous quantity of earthwork.

(ii) *Bridging*—Where the alignment of the new Link cut across drainage, streams and rivers, 368 channels varying in widths from 3 ft. to 1425 ft., had to be spanned by bridges over a distance of 250 miles within one working season. This involved practically every type of bridge constructional techniques.

(iii) *Railway track*—Although the route mileage of the Assam Rail Link is 142.55, the total length of track laid consisting mainly of 60lbs. rails on sal wood sleepers, exceeded 200 miles, which also included temporary diversions, running loops and sidings.

(iv) *Personnel*—The men who did this vital job were 35 officers, 707 subordinates and a labour corps 6,777 strong. Up against the immense odds offered by the rugged country, long spells of torrential rain, an unhealthy and malarial climate, thick and tough jungles, where wild elephants, tigers and other enemies of man lurked, fierce, swift-flowing rivers and streams, and occasional subversive propaganda, these men slogged and toiled through all this; and in the short space of 24 months had the Assam Rail Link completed and the traffic rolling. The constructions of a vital rail Link of only 143 miles, but an achievement which required all that man, and railwaymen of all categories in parcticular, were capable of—grit, courage, sweat and toil, superb engineering and railway operational skill, and terrific endurance—truly an achievement that India can be proud of, and always have a sense of deep gratitude to the men who accomplished the task.

***I am not asking for martyrdom but if it comes in my way in the prosecution of what I consider to be the supreme duty in the defence of the faith of love, I shall have earned it.*—M. K. GANDHI**

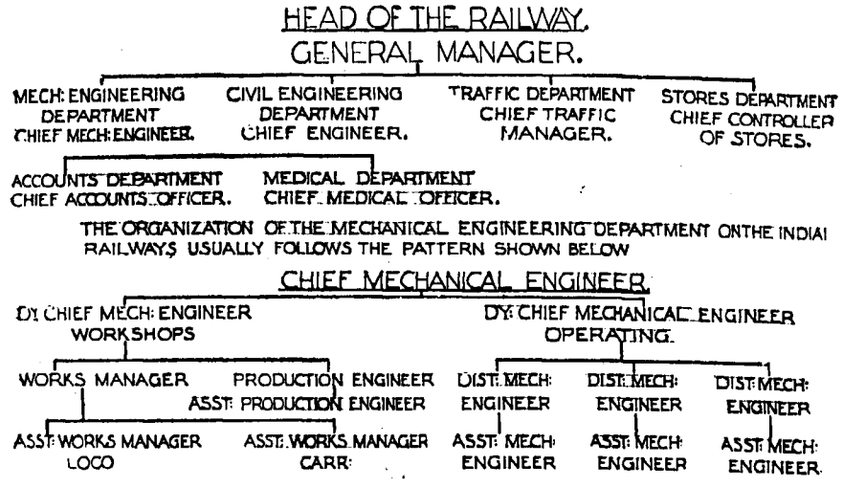
The Work of the Mechanical Department of Indian Railways

By Kailash Nath, M. Sc., A. M. I. Mech. E. (London) A. M. I. Loco. (London)

District Mechanical Engineer, O. T. Railway

THE main function of the Mechanical Engineering Department on Railways in India is to maintain Locomotives, Coaches and Wagons in good working condition. We will see how this is achieved.

The typical organization of a Railway Administration in India is shown in the chart below :—



THE WORKSHOPS :—

Every Railway usually has one or more than one workshops where major repairs to Locomotives, Coaches and Wagons are carried out. These workshops are fairly large. The biggest amongst the Locomotive repair workshops is the E. I. R. Workshop at Jamalpur which employs about 10,000 men.

The following are the major Railway Workshops in our country :—

E. I. R.	1. Loco. Workshop	... Jamalpur.
	2. ,, ,,	... Charbagh, Lucknow.
	3. Carr. & Wagon	... Lilooah.
	4. Carr. & Wagon	... Lucknow.
B. N. R.	Central Workshop	... Kharagpur, Nagpur.
O. T. R.	1. Central Workshop	... Goraghpur.
	2. Loco. Carr. & Wagon Workshop	Izatnagar (Bareilly).
	3. ,, ,, ,,	... Samastipur.

B. B. &. C. I. R.	1. B. G. Loco. Workshop	... Dohad.
	2. B. G. Carr. & Wagon Workshop	Bombay.
	3. M. G. Loco. Workshop	... Ajmer.
	4. M. G. Carr. & Wagon Workshop	Ajmer.
G. I. P.	1. Loco. Workshop	... Parel, Bombay.
	2. Carr. & Wagon Workshop	... Matunga, Bombay.
	3. Loco. Carr. & Wagon Workshops	Jhansi.
M. S. M.	1. B. G. Loco. Workshop	... Perambur, Madras.
	2. B. G. Carr. & Wagon Workshop	,, ,,
	3. M. G. Loco. Carr. & Wagon Workshops	Hubli.
S. I. R.	Central Loco. Carr. & Wagon Workshops	... Golden Rock, Trichinopoly.

LOCOMOTIVE REPAIRS :—

Repairs to Locomotives can be classified as :—

1. HEAVY REPAIR ALSO KNOWN AS PERIODICAL OVERHAUL

The Locomotive is completely stripped. The boiler is removed from the frame. All other components are removed from the Locomotive and only the frame is left intact. Each part is thoroughly examined. If it is badly worn out, it is replaced by a new part, otherwise it is repaired, reconditioned and used again.

There are more than 1200 parts on a Locomotive. You can therefore, imagine the amount of work that is involved in a Heavy Repair. It is almost building a new Locomotive. As a matter of interest, the following figures may be given :—

Average cost of Heavy Repair of a B. G. Loco. Rs. 24,000/-
,, ,, ,, ,, ,, M. G. Loco. Rs. 19,000/-

Usually the heavy repair is given to the Locomotive after it has done 3 years of service. Some Railways follow the mileage basis and give heavy repairs after the Locomotive has done from 1,00,000 to 1,50,000 miles. On the average it takes 20 to 25 working days to complete a heavy repair in the workshop.

2. INTERMEDIATE REPAIRS

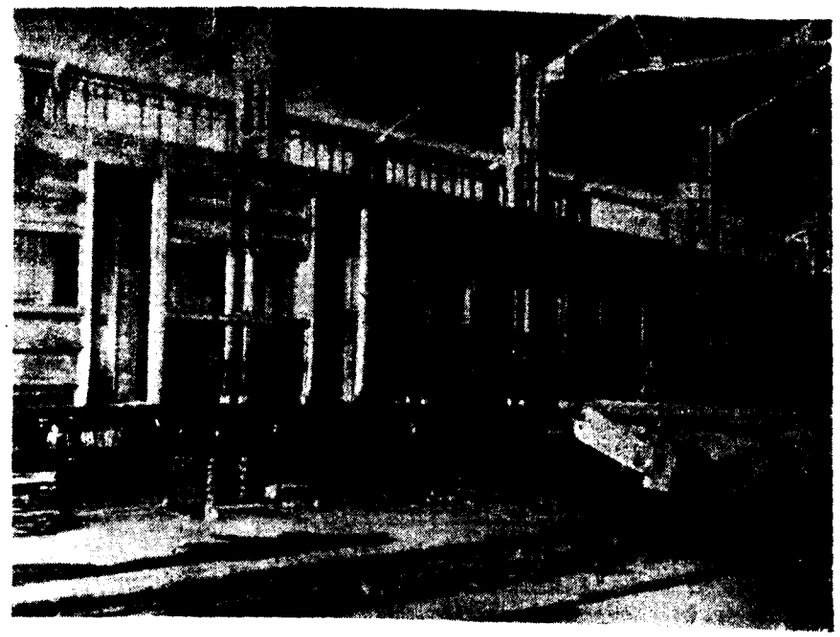
The Locomotive is called in shops for attention to axle boxes, connecting and coupling rods, motion parts etc.—the components which are worned out to a considerable extent and require attention. This is mostly given after the Locomotive has done about 50,000 miles in service. Other parts of the Locomotive which require repairs are also attended.

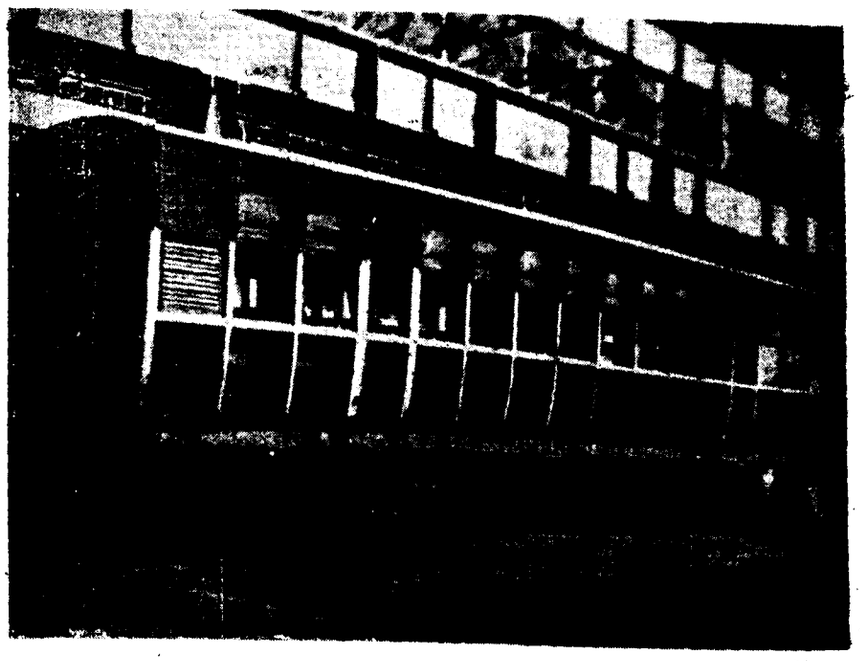
3. CARRIAGE REPAIRS

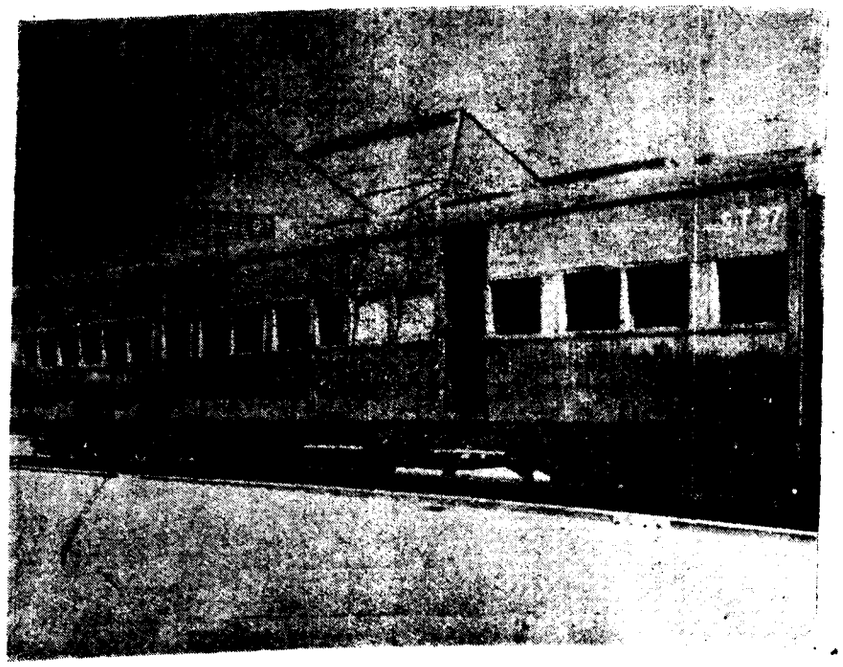
Depending upon the mileage done by coaches, they are sent to shops for heavy repairs. On some Railways, coaches are given heavy repairs after 2 years' service and on other Railways, main line rakes which earn heavy mileage, are given heavy repairs after 12 months in service.

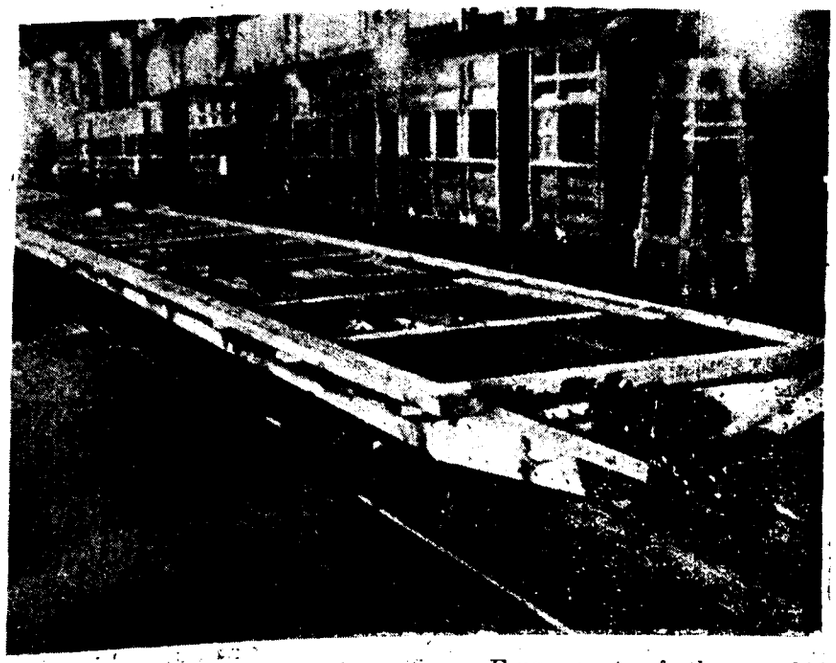
The coach is lifted off its bogies and the bogies are run out. In case where the underframe,

Various Stages in manufacture of Rail Coaches at Central Loco. Carriage and Wagon Workshops, Southern Railway, Golden Rock



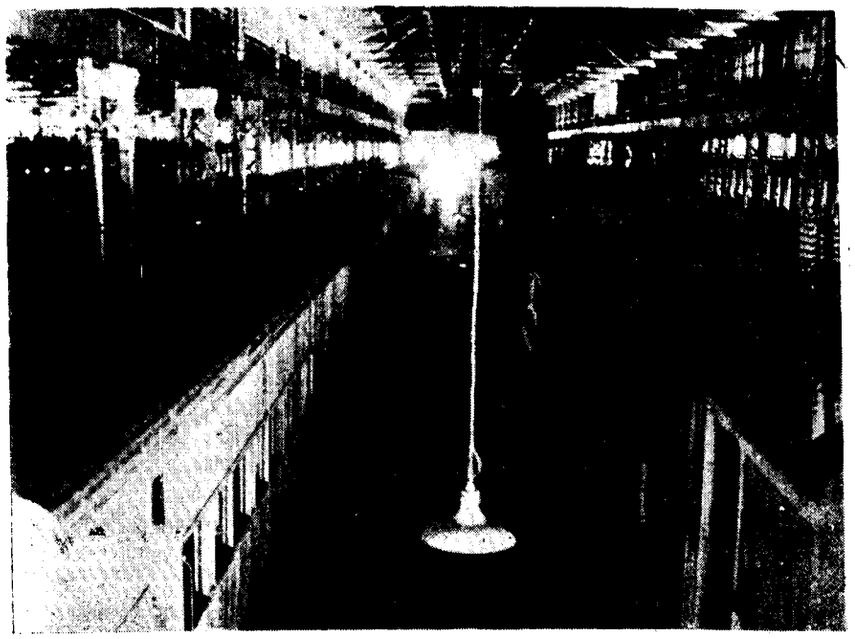


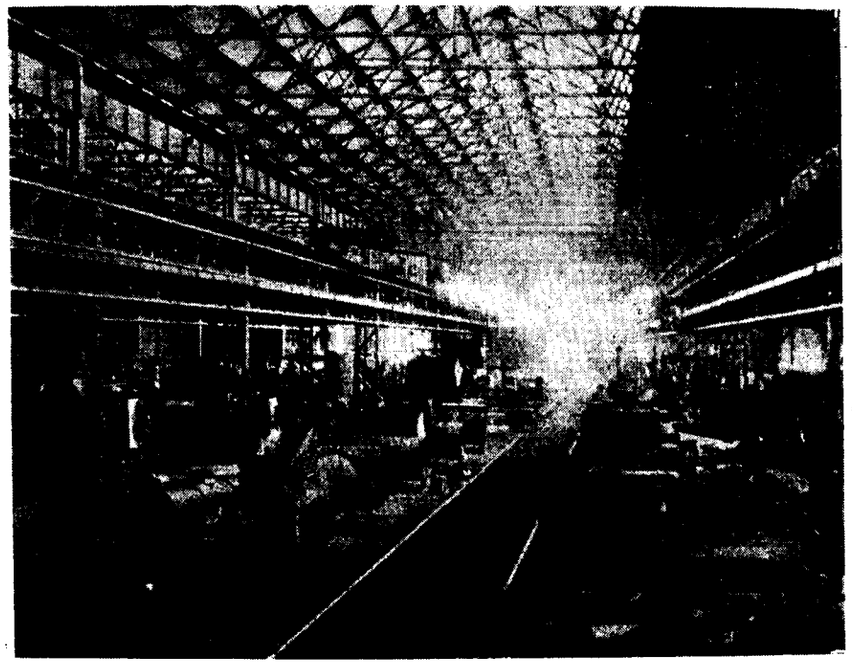




which is made of steel, also requires attention, the body is separated from the underframe. The lifting of the coach body is done by means of Electric Cranes.

Every part of the coach is given a thorough examination. Some coaches arrive in shops in such a dilapidated condition that it requires almost rebuilding. This





involves very heavy work in shop. Unfortunately at present there is a very high incidence of thefts of carriage fittings. There is also very heavy damage due to vandalism. Cushions are ripped open, rexine covers are cut, cushion spring are stolen away, Mirrors, Wash Hand Basins, Electric Fans, Bulbs, Switches, Fan Regulators and other parts are stolen away. Indian Railways, suffer a loss of approxi-

nately 50 lakhs of Rupees per year due to these thefts and wanton damage. This is a very serious loss to our National Railway. These carriage fittings are at present extremely difficult to procure and the maintenance of coaches in good condition is, therefore, made very difficult.

The cost of heavy repair to Broad Gauge Bogie coach comes to Rs. 5000/- and that of Metre Gauge Bogie Coach comes to Rs. 3000/-

4. WAGON REPAIRS

Wagons are given P. O. H. after 3 years of service. On arrival in workshops, every part of the wagon is thoroughly examined and repairs are executed wherever necessary. The wagon is also tested for water tightness by putting it under shower. This is to make sure that there is no leakage of rain water inside the wagon to avoid any damage to the consignment.

The cost of P. O. H. of a Broad Gauge 4 Wh. Wagon amounts to Rs. 500/- and that of a Metre Gauge 4 Wh. Wagon is Rs. 350/- Total No. of Locomotives are 8,000, Carriages 20,000, and Wagons 2,10,000 on the Indian Railways. This will give an idea of the amount of work involved in good condition.

5. MAINTENANCE OF ROLLING STOCK ON THE LINE

We have seen the part played by the Workshops in carrying out major repairs of rolling stock, but it is to be remembered that the time spent in workshops is very small as compared to the time in service. The maintenance of rolling stock while in service is done in Loco. Running Sheds and Carriage and Wagon Repair Lines.

6. LOCO. RUNNING SHEDS

Not many people are aware of the existence of the Running Sheds where engines are stabled when off duty. On arrival of the train at its destination, the engine driver takes his engine to the shed. The engine is given a complete examination by the driver and the Engine Examiner jointly. All defects are noted down so that these can be attended to in the Running Shed. The driver then hands over his engine to the shed shunter and breaks off duty. After examination, the engine is taken for fuelling. Coal is put into the tender either manually or by the steam coaling crane. The latter is used in big sheds where more than 100 tons of coal is consumed in a day and manual coaling requires a large number of coal khalasis and also takes more time.

After coaling, the fire is dropped and steam is allowed to escape from the boiler. When the boiler has coolled down, it is given a wash out. This is done with a view to remove of scale and sludge which has accumulated inside the boiler. On our Railways the boiler is washed down after the engine has done about 700 miles of service. On some Railways where the water is soft and does not contain scale forming salts, the boiler receives a wash out after 1,500 miles in service. On some Railways like B. N. R. , there are water softening plants which remove scale forming salts from the water by a chemical process known as Water Softening. The presence of scale in the boiler is objectionable for many reasons. A few of these are (1) Formation of scale on the boiler plates reduces their heat conductivity. This results in greater fuel consumption as the head produced by the combustion of coal in the firebox is not easily transferred to the water for conversion to steam. Boiler scale is bad conductor of heat. (2) The plates on which boiler scale adheres are subjected to over heating. This results in

damage and burning away of the plates. (3) The water spaces in the boiler also become choked up and result in damage of the boiler. (4) Some salts present in water cause corrosion and the metal components of the boiler are corroded and eaten away.

While the boiler is being washed out, the fitters and other staff are busy carrying out the repairs which have been booked by the driver. If there is sufficient time available before the engine starts on its next trip, the engine parts are also given a scheduled examination similar to the Periodical servicing given to Motor Cars in garages. The idea behind this regular servicing is to keep the Locomotive in fit condition for service.

Not many people are aware that running of the Railways require a big army of Railway Men who are busy in carrying out their duties day and night, in hot summer days and cold wintry nights, in torrential rains and scorching sun. The magnificent part played by the Railway Men in keeping the country's transport services running has not received due appreciation from the public. It is hoped that there will be a greater understanding in future between the Railway Men and the public in general.

7. TRAIN EXAMINING STATIONS

Passenger and Goods Trains are given regular examination at various points to ensure that the coaches and the wagons are in a safe condition to run. These examining points are usually spaced at distances varying from 50 to 100 miles. Train Examining Staff post themselves on either side of the Railway Line at the incoming end of the Railway Station and minutely watch the running of every coach as it runs past them. These staff watch the wheels and other parts of the coach and make sure that there is nothing out of the way. After the train has come to a stop, the staff designated as Wheel Tappers walk from the rear of the train to the front, examining and sounding every wheel of the coach with the help of wheel tapping hammers. From the sound they are able to judge whether there is any defect on the wheels. They also feel the condition of every axle box. In case of defect on the coach which makes it unsafe to run, the coach is detached from the train in the interest of the safety of the public.

At Junction and Main Railway Stations there are squads of Carriage Cleaners, Sweepers and other staff. It is the duty of these men to clean each and every compartment and latrine and to fill up water in the tanks which supply water in the carriage lavatories. This is free service for which these staff should not be paid any tips.

8. CARRIAGE WASHING & REPAIR LINES

At Terminal Stations the carriages are taken on to the Washing and Repair Line. There each carriage is given a thorough cleaning and washing. Minor repairs such as defects in the window shutters, compartment doors, lavatory fittings etc. are attended to. The Alarm Signal Chain Apparatus is tested and maintained in good working condition.

The foregoing paragraphs give in brief the work done by the Mechanical Engineering Department in maintaining the Rolling Stock on our Railways. Apart from this, the manufacture of locomotives, building of new coaches, building underframes etc. are also undertaken by the

Mechanical Engineering Department of the Railways. It may be pointed out that apart from the newly started Chittaranjan Workshops for the manufacture of Locomotives, E. I. Railway Workshops in Jamalpur and B. B. & C. I. Railway Metre Gauge at Ajmer had built quite a large number of Locomotives. The latter workshops are still building new Locomotives. The building of new Locomotives, therefore, is not anything new to the Railway workshops in India. The repairing of engines badly damaged in accidents involves work as heavy as building of new Locomotives.

Most of the passenger coaches, now in use on our Railways, have been manufactured in the Railway Workshops in India. Each Railway Administration is very busy at present with the programmes of building new coaches with a view to relieve overcrowding in passenger trains. It may be expected that the position will greatly improve within the next three years and the arrears of coach replacing programmes accumulated during the last war, will be soon wiped out, and additional coaches will also be put in service to cope with the increase in passenger traffic.

Poets and pigs are not appreciated until they are dead.—ITALIAN PROVERB

The Great Exhibition of 1851

By a Correspondent

ONE hundred years ago the Great Exhibition was opened in Hyde Park. On May 3rd the King opened the Festival of Britain site on the South Bank of the River Thames in London. This great festival, with all its elaborate buildings and attractive features, marks the centenary of the Great Exhibition of 1851.

To use its full title "The Great Exhibition of the works of Industry of all Nation" this venture was a success from the beginning, industrially, educationally, inter-nationally and financially. It developed from a curious collection of small beginnings, from a modest show of decorative consumer goods held by the Society of Arts (later Royal) in 1756; from the five yearly displays which the French had developed under Napoleon, from three modest exhibitions which the Society of Arts produced between 1847 and 1849 and from the great Parish Exhibition of 1849. The most important development sprang from an interview at Buckingham Palace between the Prince Consort and Henry Cole when they were discussing the possibility of holding a great industrial exhibition in London in the year 1851.

They had met as fellow members of the Society of which the Prince was President and the possibility of making the exhibition an international one was raised. The French had considered the problem with their own exhibition and finally decided to limit the exhibition to national products. The prince said "It must embrace foreign productions—international certainly." This sentence changed a modest project to help British manufacturers into a venture of unlimited scope.

Originally the concern of a small but private society the proposal now became the responsibility of a Royal Commission with the Prince Consort at its head. Its task was to obtain the sympathy of parliament but no financial support was asked for and also the support of industry from whom it sought moral and financial aid. Parliament gave its support readily enough but there were terrific arguments regarding the site. Henry Cole and a Dr. Lyon Playfair were responsible for a brilliant campaign of propaganda which won the confidence of industry.

It was proposed to use Hyde Park as the site and there was much controversy over this. The building committee launched a competition for a suitable design for the building and 245 designs from all over Europe were received and rejected. In desparation the building committee made its own design, a brick structure which would have been four times the length of Westminster Abbey and using 15,000,000 bricks. The design provoked severe criticism.

At this time Paxton's Crystal Palace came into being. Joseph Paxton was born at Milton Bryant, Beds on August 3, 1801. He was head gardener to the 6th Duke of Devonshire at Chatsworth. He started as a garden boy to a local landowner. There was no free education at that time but Paxton did well on his own initiative with private study. In due course his ability and industry brought him to the position of foreman at the Chiswick Gardens of the Horticultural Society. Next to the Society's gardens was one belonging to the Duke of Devonshire who soon noticed the young gardener and his abilities. In 1826 the position of head gardener at Chatsworth became vacant and it was given to Paxton who was then only 23. A unique relationship developed between Paxton and the Duke and in the course of years he became his companion, friend and adviser.

Paxton became interested in the development of Railways at an early age and among his friends were the two Stephensons and George Hudson, the "Railway King". In spite of these and other interests the zeal of his work at Chatsworth continued. Keen on designing green houses he was responsible for the Great Conservatory and the Lily House.

Paxton as a Director of the Midland Railways was Chairman of the Ways and Works Committee and on this occasion (June 1850) they were considering, as an item on the Agenda, a minor fault committed by a pointsman. During this discussion Paxton had appeared to be making lengthy notes on his blotting pad. One of the other directors, who had noticed this, suggested that they obtained the decision from Paxton. His reply was that he knew all about the pointsmans' case but what he had been busy on was a design for the Great Industrial Exhibition!

Later, he was visiting Mr. Ellis, then Chairman of the Midland Railway, in the new House of Commons, which was being tested for acoustics, with unsatisfactory results, and Paxton observed that he hoped a mistake like this would not be made over the Exhibition building. Mr. Eilis spurred him on to visit the Board of Trade and he promised them that they should have complete plans in nine day's time. His idea was to design a building in glass and iron similar to the Lily House at Chatsworth. He took home the blotting paper sketch and started on the plans and in this he was assisted by the Midland Railway Engineer.

On the return journey to London he met George Stephenson at Derby Station who was one of the Royal Commissioners. Stephenson was shown the plans and he promised to lay them before the Commission. There were interviews with Prince Albert but considerable opposition came from the building committee who did not want to give up their brick monstrosity. However, Paxton published his design in the *Illustrated London News* and so great was the public support that the Building Committee gave up all opposition. So Paxton's Crystal Palace became a reality. The name was given to it by *Punch* and accepted with great delight by the public.

The building was designed to use prefabricated, mass produced units and was started in September 1850. It was complete in February 1851 and with a huge assembly of over 100,000 exhibits was ready to be opened on May 1 by Queen Victoria. The building was 1,848 feet long, three times the length of St. Paul's Cathedral, with a huge central nave divided into equal halves by a giant vaulted transept 180 feet high. Aisles and galleries were situated along the central avenue and provided more than 990,000 sq. ft. of verticle and horizontal exhibition space.

The Great Exhibition was an exhibition of industrial consumer goods. It had mainly six divisions, raw materials, machinery, textile manufactures, metallic, vitreous and ceramic manufactures, miscellaneous products and fine arts. The hardware included anything from pins to full sized locomotives.

The exhibition was opened on May 1 and closed on October 11. It was not opened on Sunday so it was actually open 141 days. In this period 6,039,000 visitors came,

a daily average of 42,000. They came from every part of the country, from every part of the world and from every class of population.

Prince Albert adhered to his guarantee to remove the palace from Hyde Park in 1852. Its influence did not, however, diminish or the building disappear. It was sold to a private company who erected it, in a modified form, on Sydenham Hill. It was flanked with two tall circular towers also of glass. It was burnt down by a disastrous fire in 1936.

When the Royal Commission had paid all the expenses, there was a net profit of £186,000. The Commission was re-appointed permanently to administer these funds which it does today. It bought the great site at South Kensington in which stands colleges and museums like the Natural History, The Victoria and Albert, The Science Museum etc. It also supplies funds for educational purposes and scholarships. In a century of public service the Commission has paid out more than £1,800,000 and at the present time commands an income of about £29,000 per annum.

Joseph Paxton was knighted for his design of the Crystal Palace.

Power takes as ingratitude the writhings of its victims.—TAGORE

HINTS TO GUARDS IN GENERAL

Guard against theft by always being alert on duty.

Outgoing Guards should see that they receive a copy of the invoice for each sealed loaded wagon on their train.

Observe the rules which prohibit rough shunting, especially wagons containing explosives, oil, live-stock and fragile goods.

Don't start your train without seeing that loads on open trucks are properly secured.

See that all wagons loaded with merchandise on your train are correctly sealed and rivetted and check your couplings.

Accidents can be minimised by being vigilant and careful in your work.

Never neglect to see that the last Vehicle on your train has a tail lamp, is clear of the fouling mark, and that signals in rear have been returned to the 'ON' position.

Don't forget to protect your train by using detonators, especially the adjacent line when accident occurs where double line working is in force.

Passengers should be treated with civility and tactfulness to gain their confidence.

Alarm chain when pulled should be investigated immediately.

See that the third class ladies' compartment is next to the upper class carriage.

Special attention should be paid to security bolts and catches in ladies' compartments.

Ensure that all passengers are entrained before giving the starting signal.

No parcels or luggage should be accepted unless clearly and legibly labelled, and accompanied with P. W. Bill or L. Ticket.

Guards should lock their Brake Van and Dog-Box doors to prevent theft.

Especially see the tape and seal of the cash bag is correct before dropping it into the cash safe.

Remember your duty when a passenger is suffering from an infectious or contagious disease.

Give the required attention to your equipment and see that it is properly kept.

Use your commonsense in an emergency.

Advise the yard staff by memo, on arrival at destination, of wagons containing perishables, live stock and dangerous goods to avoid rough shunting and detention in yards.

Remove causes giving rise to payment of claims by careful handling, correct loading and unloading and repacking.

Duty done well is always appreciated.

Service to the public first, last and at all times.

(Inserted in the interests of our Railwaymen)

HINTS TO ENGINE DRIVERS IN GENERAL

A Driver must never start his train until he is in possession of a 'Line Clear' and he must also ensure that the 'Line Clear' belongs to the correct section. Remember it costs 50 times more to the Public Exchequer to introduce 'Token Line Clearer System' than to work trains on 'Paper Line Clear System.' Our country can ill-afford this huge expenditure unless the drivers do their duty.

A driver must never disobey a Signal. Remember that disobedience to signals may not only cost you your own life, but you are also answerable to your conscience for the hundreds of lives travelling in your trian. Remember also that the success of providing inter locking at any station depends on your implicit obedience to the Signals and the huge expenditure incurred over it may be entirely defeated, if ever once you disobey a Signal.

HINTS FOR STATION MASTERS

A Station Master must never allow the Token instrument to be handled by any unauthorised staff. Remember it is a great facility to you and you should not abuse it. Never hand over a Line Clear to a Driver till you are satisfied that all is safe for the despatch of the Train.

A Station Master must never lower a signal till he is satisfied that all the conditions for lowering a signal are fully satisfied. Remember always that the signals impart a lot of information to a Driver and that on the correctness of this information depends the safety of the travelling public.

HINTS FOR THE TRAVELLING PUBLIC

It has often been noticed that the Public crowd round the Station Master in and outside his office making anxious enquiries about the train running or other personal matters. Remember that your safety depends on the efficient working of the Station Master. Please, therefore, do not make his task more difficult by worrying him with your queries. Either go to the Enquiry Office or if there is none, consult the Station Master only when he is free from Train Passing Duties. You will help the Administration and you will help yourself.

(Inserted in the interests of our Railwaymen and the Public.)

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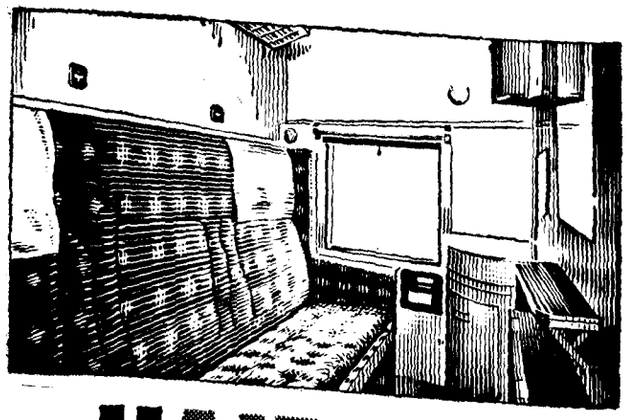

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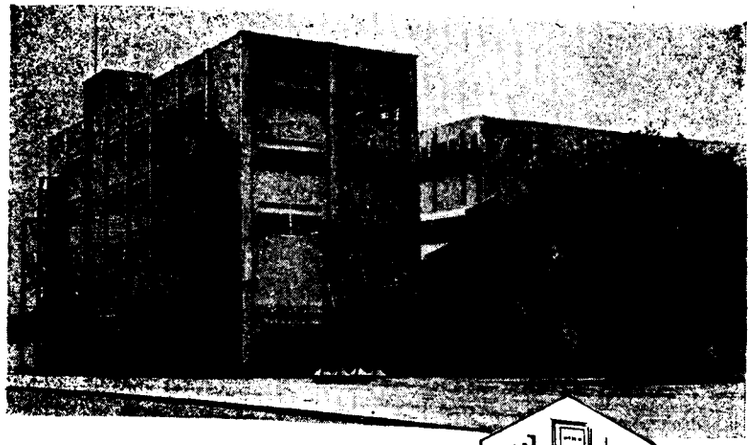

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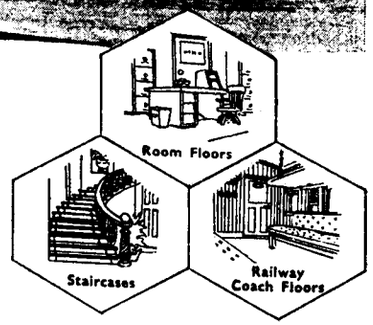

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SOUTHERN RAILWAYS MAGAZINE

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Reliability and Comfort

IT is learnt from a news item that Mr. Lorimier, President of the Britsh Locomotive Manufacturers' Associatiou, after a short visit to India and before his departure at the end of May, said that Indian Railways 'stood high in reliability and comfort' among the Railways of the world. Is this commendation justly deserved ?

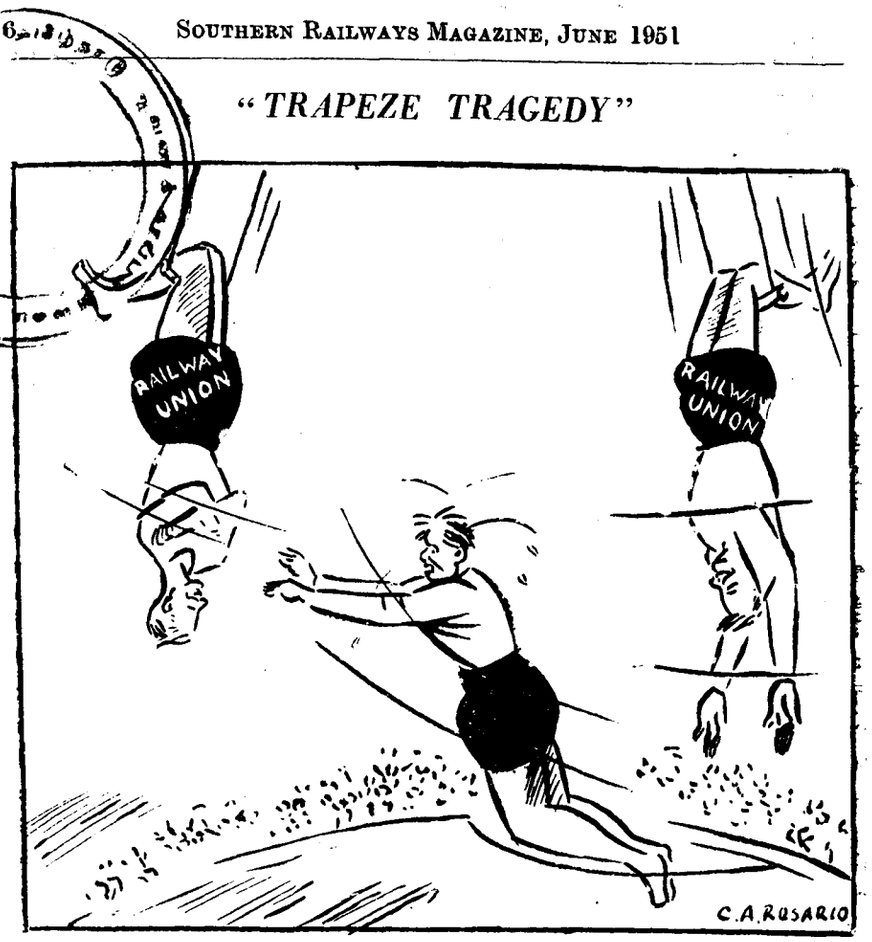
If the vast travelling public of this land were asked for their opinion, they would in all probability disagree, and they would offer their reasons somewhat on the following lines.

From the viewpoint of reliability they would cite instances of lack of train punctuality, because efficiency and reliability is judged on the ability of Railway Administrations to keep trains running 'on time.' But would this be a fair judgment ? The public would point out a number of cases in which trains were running late in the course of a month. Taking these complaints into consideration would perhaps give an impression of unreliability ; but what the public are not aware of is the overall picture of puntctuality. If they knew the 'inside story' of this one aspect alone, and cared to study the statistical facts and figures published in the annual reports issued by the Ministry of Railways, they would find that trains on Indian Railways ran very much more 'on time' than otherwise. A closer study of the other material available in these reports would also reveal that efficiency and reliability on Indian Railways could justly be termed as 'high.'

From the viewpoint of 'comfort' public opinion will be is emphatic disagreement. Here obviously the standard of judgment in that a passenger who has paid for a rail journey at least expects a reasonable space even in a third class compartment which he can call his own for the duration of the journey. But more often than not, in the present state of overcrowding in trains, what he gets is only standing room if he happens to be a late-comer to his compartment. This problem of overcrowding, which cuts at the root of standards of comfort, no matter what other comforts may be provided, is still, to be tackled and resolved in its entirety. But all Indian Railways are tackling this problem vigorously, and relief is being provided

(*Continued on next page bottom*)

"TRAPEZE TRAGEDY"



The position of Railwaymen by leaving one Railway Union and joining another is becoming all the more precarious

although somewhat not as rapidly as desired, by putting on more and more trains, as more and more rolling stock is being built and put into service. In the course of time, at the rate of progress now being made, it is reasonable to expect that the recurrent problem of better comfort on journeys by rail will be solved to the satisfaction of the passenger, when he will have to admit the Railways of his country can provide the comfort desired.

In conclusion, although a fitting tribute has been given to Indian Railways for reliability and comfort, Railwaymen in India, who have worked and are still working to maintain this standard, should not rest back on their achievements, but strive for better ideals, so that our Railways will be second to none amongst the Railways of the world.

Notes and Comments

COCHIN—TRIVANDRUM RAIL LINK

A Correspondent from Trivandrum writes :—" It is strange that one of your correspondents should hear about the Cochin-Trivandrum rail link proposal only now, some months after it emerged into the open and after the preliminary survey work has already been started, and should now champion the cause of effecting a large economy in public expenditure. I need hardly point out his views do not represent public opinion in this State which is solidly behind the scheme with a firm conviction of its utility and necessity.

The arguments advanced by him are unconvincing. He hears that the railway cannot compete with the cheaper backwater traffic. He should know that railways in many parts of India before have had to compete with the more modern and powerful rival, the bus, and they have come out successful almost everywhere. Besides, the travelling public as a whole do not generally look to cheapness alone but also to comfort, convenience and quickness. The difference in gauge between the existing lines is not a major difficulty. Your correspondent says the cost of the scheme will be prohibitive but at the same time suggests that the route between Cochin and Trivandrum can be connected by a cement-concrete road and that a fleet of fast diesel buses could be run. This is easier said than done. Is not the scheme of cement-concreting the entire length of the road and running these buses costly enough and will there not sometimes be greater difficulties in its execution? He also suggests that the "canals all round" may be deepened for "steamers" to ply. I confess I fail to understand how far these alternatives will promote economy.

In this connection I beg to suggest that the proposed railway may be laid alongside the present bus route from Alwaye to Kottarakkara and thence via Kilimanoor and Nedumangadu to Trivandrum. This route will be more useful and paying in the long run, besides being basically more promising of future all-round development in the industrial, agricultural and social economy of this State."

***

Sri A. Vasudevan, Shoranur, also writes on the same subject: "The reasons advanced by various Correspondents appearing in news papers for withholding a scheme for connecting Cochin with Quilon by rail are not sound. It is a long-felt need and apart from raising the standard of living of the people of the State, it would attract a very large volume of trade, increased passenger traffic at comparatively low cost and help to develop many undeveloped areas. A dispassionate consideration of this proposal by non-interested parties will, undoubtedly, convince them of its necessity.

The question of cost should not stand in the way of its early execution, especially when we consider the huge revenue it will bring forth. The time factor as well as the low back-water charges anticipated as competition can only be in favour of the proposed scheme, taking into consideration the speedy movement of goods and passenger traffic from one end to the other together with the safety and comfort it affords. The bus traffic can also thrive even when the rail link is established."

***

THIRD CLASS RAILWAY COACHES

Sri C. V. Soundara Rajan, Vice-President, Tenkasi Railway

Passengers' Association, writes :– "When the authorities of the South Indian Railway were urged some two years ago to run an additional Shuttle train through the Chord line from Shencottah to Virudhunagar and vice versa for the convenience of passengers on short-distance journeys, as they invariably crowd express trains, the reply was that it involved engine power and rolling stock which were not available. Even now only two passenger trains run between these two stations in addition to Express Nos. 5 and 6.

The Financial Commissioner of Railways at the beginning of last month announced in Bombay that by the end of this year 38 air-conditioned coaches would be ready for service, evidently intended to provide more amenities for upper-class travellers. The manufacture of such costly coaches can surely wait until the full complement of third class coaches is provided first."

*** *** ***

REFUND ON PASSENGERS' TICKETS

The N. S. Railway Administration had stated in their Weekly News Letter dated 9th June 1951 that "refund of fares on unused tickets can be had at the station at which they are issued provided they are returned within 3 hours after the departure of the train when they cannot be used for want of accommodation in the train and within 2 hours after the departure of the train for other reasons.

The cost of first and second class tickets purchased in advance to permit of reservations will, if surrendered more than 3 days before the date of commencement of the journey, be refunded less 5% discount. If surrendered within 3 days before the date of commencement of journey, fares paid less 10% discount will be refunded.

Station Masters have authority to refund charges, less discount referred to, up to a limit of 2 hours after the departure of the train for which tickets have been issued. Thereafter, refunds will be made only in special circumstances on application to the Chief Traffic Manager (Commercial), N. S. Railway, Secunderabad, and any refund made will be subject to a deduction of 10% of the fare paid.

Passengers claiming refund on tickets must deliver the tickets at the station of issue and obtain a certificate from the station Master which must accompany the application addressed to the Chief Traffic Manager (Commercial), N. S. Railway, Secunderabad.

*** *** ***

NEW UNDERFRAME SHOPS AT ONDAL

The Government has decided to convert and extend the existing sheds at Ondal, on the East Indian Railway, as a Carriage and Wagon Underframe Works at a cost of some Rs. 60 to Rs. 70 lakhs. This is in keeping with the manufacture of locomotives at Chittaranjan. As Carriage and Wagon bodies are already built in India, these two new factories will complete the manufacture of all types of rolling stock and spare parts.

*** *** ***

NEW MULTIPLE UNIT STOCK FOR SUBURBAN SERVICES

The present position in regard to the Multiple Unit Electric Stock is that the existing stock have been worked to the fullest capacity and need urgent repairs and rehabilitation which are long overdue. The new Multiple Unit Electric Stock for which order was placed in the United Kingdom about three years ago has just started arriving. Two motor coaches have actually arrived at the Bombay Docks by S. S. "Empire Spartan" on the seventh of last month and have been unloaded. Arrival of the remaining stock is scheduled as follows :—

Two Motor Coaches by S. S. "Clan McBean" leaving Birkenhead on May 3, 1951.

Two Motor Coaches and four Trailers by S. S. "City of Ely" leaving Birkenhead on May 9, 1951.

Four Motor Coaches by S. S. "Jalakanya" leaving Birkenhead on May 16, 1951.

All this stock is of very modern type and the brake equipment has been supplied by Westinghouse which is entirely different from the equipment now in use.

Acceptance tests will be carried out and the staff will be trained in working the new stock after which the stock now in use will be taken out for repairs and rehabilitation and substituted by the new stock.

When more electric energy is available later on the Railway will be in a position to utilise the additional Multiple Units in regular train services. Until then the present services will be maintained with the new and the old stock.

It may be pointed out that

The new Electric Coach manufactured by Messrs. Metropolitan-Cammell Carriage and Wagon Company of Birmingham, which arrived for use on G. I. P. Railway, by S. S. "Empire Spartan" on 8th May, 1951.

Interior view of the Coach

the arrival of the new stock in no way means the immediate augmentation in the Suburban Train Services.

***

EXTENSION OF POWER SIGNALLING ON G. I. P.

It is common knowledge that a number of additional multiple unit stocks has been placed on order in the United Kingdom and the first instalment of these has already arrived in Bombay. This was but the first step towards reducing congestion in the Suburban train services by increasing the train frequency. Another vital but perhaps little known step is to be taken before this objective is achieved and that is the installation of the automatic block system on the local lines with colour light signals.

It is now the accepted practice on the Indian Railways to work trains on the 'space interval' system, which means literally that between any two trains there should be a specified space interval. This space interval is secured on the Suburban Section from Victoria Terminus to Byculla and on the Harbour Branch automatically by the use of track circuits, without the aid of any human agency. On the section beyond Byculla, however, admission into block sections is controlled by Station Masters with the aid of block instruments and as is well known the main function of block instruments is to reduce errors of the human element. But the regiment prescribed for the use of block instruments requires a certain amount of time and it should be obvious that the frequency of trains must always be greater than the time required to complete the procedure prescribed for the operation of block instruments.

From this point of view as well as from the general safety point of view it is necessary to replace the block instruments with track circuits on the Suburban section before any further increase in the already high train frequency can be made.

The original intention was to extend the provision of colour light signals and track circuits on the Suburban section on all the four lines simultaneously commencing from Byculla and proceeding in stages up to Ghat Kopar. In view of the recent decision to augment the Suburban train services in the near future, it was decided to proceed first of all with the provision of track circuits and colour light signals on the local line section alone between Byculla and Kurla and to give it the highest priority.

Apart from gaining the immediate objective with regard to effecting an increase in the suburban train services this work, which is estimated to cost Rs. 4·28 lakhs, will considerably increase the safety factor in the operation of trains on this Suburban section. The colour light signal is the only solution to the problem of the driver of a fast approaching train obtaining a satisfactory view of the signal in the electrified area, where a forest of traction structures now impedes the view of mechanical semaphore signals. The colour light signal also eliminates the possibility of a signal displaying an ambiguous aspect or a dim signal light.

In this work it is proposed to incorporate all the modern developments in signalling practice to the extent possible. The scheme consists of 58 new track circuits and 38 new colour light signals, and involves the installation of over 168 relays. Special arrangements have been devised to ensure safety while crossing over from the automatic block territory to the non-automatic and vice versa.

It may be recalled that when Power Signalling was first installed in India on the G. I. P. Railway the work was carried out by Contractors who imported foreign Engineers for the design of circuits and the supervision of the installation of electrical equipment. But this time the planning and the execution of the work is all being carried out departmentally. This is not only more economical but affords an excellent opportunity for the staff of the G. I. P. Railway to gain valuable experience in a Major Power Signalling Project.

(Continued on next page bottom)

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ELECTRIC TICKET ISSUING MACHINES ON G. I. P.

The G. I. P. Railway has led the field by being the First Railway in India to install electric ticket printing and issuing machines. These machines were given a trial last year and three have now been installed permanently in the suburban booking office at Victoria Terminus. Other machines are about to be installed at Masjid, Byculla, Dadar, Matunga and Kurla.

The machines that are at Victoria Terminus are similar to those on the London Underground. Each can issue six different tickets of different values. They are operated by the booking clerks, who by simply pressing a button, can issue one, two or three tickets of any kind with one operation. The tickets are issued already dated.

With these machines the speed of issue of tickets is much greater and it is expected that they will go a long way towards reducing the queues which form at booking windows during the rush hours. It will, however, be a great help if passengers will have their correct money ready in their hand when they reach the booking window.

Southern Railway News Letter

By G. Moorthy

INTEGRATION OF SOUTHERN RAILWAY TAKING SHAPE :

TWO months have elapsed since the Southern Railway Zone was inaugurated at Madras and the integration is working to schedule. The first visible impression of the exodus from the South Indian Railway was started by the movement of the General Manager to Madras. Trichinopoly which attained importance on account of the location of the South Indian Railway Headquarters since 1891, is gradually losing its hold. The General Offices, Trichinopoly and the Junction Station opposite is a natural location aud a pride of railway planning. Added to this the tree planting and other small flower bedding have given charm to the Junction Station. By fourteenth of this month the General Manager's Office Staff would have joined the Madras Headquarters. The Chief Engineer's Office Staff follow suit and then the Operating and Commercial Branch. Everything works like a clock and the movement has gained momentum as soon as Mr. T. A. Joseph joined as Senior Deputy General Manager at Madras. There were formidable difficulties to be overcome in the process and the tact and political insight of our General Manager, solved many intricate problems. The following men have been posted as Heads of Departments on the Southern Railway :—

Mr. J. W. Restrick	Chief Engineer
,, S. R. Sharma, M. A.	,, Operating Superintendent
,, K. L. Crawford	,, Commercial Manager
,, A. J. Baker	,, Mechanical Engineer
,, Dr. Somesekar	,, Medical Officer
,, T. S. Rao	,, Electrical Engineer
,, Robson	Controller of Stores

The team appears to be a fine one and promises to achieve the expected results. In the new set up the prime function of the General Manager would be to coordinate the activities of the Heads of the Departments and work in the team laying down the broad policy. This is more than achieved as is seen from the results. The Operating Department is the most important department and in the memorandum issued on the Regrouping of Railways by the Economic Adviser to the Railway Board it is stated in para 43 :—

"It is under operation that most advocates of consolidation expect considerable economies.

Besides being a great amenity to the public, the machines are expected to be an economy. A station like Victoria Terminus, which issues more than 9 million card tickets per year, has to carry enormous stocks of tickets and the mere storage and checking and keeping the stocks of tickets filled, involves a great deal of work. With these machines, however, only rolls of paper are kept as the tickets are printed as they are issued.

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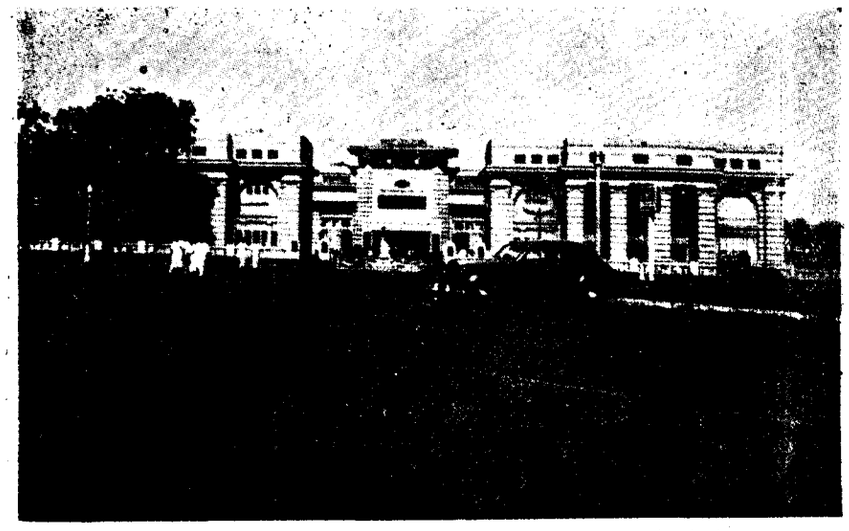

Headquarters—South Indian Railway—Trichinopoly

Firstly, the movement of traffic will tend to be gradually concentrated over the most efficient routes with consequent increase in train tonnage and related advantages, progressive elimination of circuitous routes and of wasteful transportation etc. Secondly, such concentration leads to more effective use of plant, better utilisation of locomotives and rolling stock. Thirdly, terminal operations will be simplified and more efficient operation within the terminals is to be expected. Fourthly, reduction of duplication in the passenger and freight trains and few inter-change points, will mean more single line movements under single administration and operation over most direct routes resulting in saving in time as well as in cost."

Mr. S. R. Sharma, M. A., Chief Operating Superintendent, who has a wide administrative experience and who has done a signal service to our National Government as the Public Relations Officer has already grappled the problem of organising the operating department to suit the national needs. He has given his ideas by his masterly broadcast from the Madras Radio on the "Right Man for the Right Job."

Starting with the idea "Indian National Independence" Mr. Sharma said :—

"We in India have attained freedom. We have yet to obtain the benefit of freedom. Three grim years have gone by. Our problems are many. They require urgent attention." Mr. Sharma has then masterly analysed our national economy. "We are emerging from an agricultural to an industrial economy." This statement needs clarification. Agriculture and industry are complementary and mutually exculsive. It is their balanced integration, that calls for a national economy. What we produce and what we require have to be shared on a national basis. We all must sink or swim together."

Speaking about the "Right Man for the Right Job" Mr. Sharma said :—

Above a number of workers is a Foreman or Inspector. The right

type to be a Foreman or Inspector is one who knows the job of every one in his team. Strictly speaking he must have worked up from the rank and file. He must be firm, but not tactless, critical, but not nagging, strict, but not cheap, helpful but not interfering, understanding but not pampering, and respected but nore merely feared."

Thus Mr. Sharma has started a good beginning for the integration and staff greatly appreciate the change. Similary, Mr. K. L. Crawford the Chief Commercial Manager, who rose to the present position by sheer merit, has already gripped the problems. Many may not know that Mr. K. L. Crawford is responsible for the preparation of a Monograph on "Indian Railways Goods Rating Structure" published by the Railway Board as the Secretary, Standing Advisory Committee (Post-War Rating).

I have already written on the outstanding qualities of the Chief Engineer Mr. Restrick in these pages and his services will fully bear fruit over the Southern Railway.

Mr. Baker, the Chief Mechanical Engineer has a wide experience in controlling labour at Golden Rock—an arch centre of troubles—and his experiences will be valuable for the whole group.

Something must be said of the Regrouping committee headed by Mr. L. R. Natarajan who has done valuable work in bringing the integration to a success. The work was most unenviable. Opposition, unpopularity and what not, they had to face and still undeterred they carried on their jobs. Particularly Mr. S. Sambamoorthy, the Officer-in-charge of Traffic had a tough job. His valuable experience in organising the war-time trainees, stood him well in this job. Of course there is a murmur here and there but on the whole the national experiment is a great success and by October or even much earlier, the Regrouping would have settled to work smoothly. But this is not to say that there are not difficulties to be overcome. Whatever achievements or difficulties are there, the average man will know them if only the Public Relations Organisation is organised on a proper footing. Public service suffers because it is the only business concern, which does not advertise. The general public live in grooves, are shut in among their own affairs, meet few people not of their own sort, read little. Further, in democracy, people think it a privilege to criticise the Government they very often do it in an uncharitable manner. But we cannot blame them. We know they have neither the time nor the desire to go into details. They take things as they come. They are not in possession of real facts. Had they understood the the actual state of affairs, they might have appreciated the difficulties of the Government of the day and given their ungrudging support. With the dawn of freedom in India the work of Publicity and of Public Relations Organisation has enormously increased. This had led many people to suppose that "*it is merely a camouflage to screen the real state of affairs*." Unfortunately due to lack of experience and the way in which Public Relations have been handled, this suspicion has been heightened. But they have missed its whole significance. The function of the organisation is to let people see things in the right perspective. One hopes that in the new set up this will be attended to. It is learnt reliably that Mr. T. A. Joseph is posted as Senior Deputy General Manager on the pay of a Head of a Department on the special sanction of Railway Board and that the Public Relations Organisation will be taken under his direct control.

It is a hard work in the present national set up especially when elections are nearing and one should judge only on results. But every one will surely give the unstinted support to him; for only then he can bring out the best in him for a national cause.

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SOME HIGH LIGHTS ABOUT CONTROL ORGANISATION

It is understood that on the Southern Region many important changes have been made on the control organisation, which is the nerve centre of the Operating Department. The Central Control is abolished and a separate district control has been formed. The control at Shoranur has been abolished as also the one at Erode and a District Control is being formed at Podanur. There are three Controls in the Southern Region, one at Madura another at Trichinopoly and the third at Villupuram. The Controls will be under the direct orders of the District Traffic Superintendent. What is a Control then? The system implies the centralisation in the Control Office of the supervision of traffic working over a given section of the line. Experience has shown that it has resulted in the more punctual running and speedier working of trains, the better loading of trains, and increase in the train miles per Engine hour and a reduction in light running and empty haulage with an advantage of increased line capacity. The principal advantage of train control lies in the concentration of supervision throughout a given area, and the consequent ability to arrange the working in that area hour by hour according to prevailing circumstances. Thus, instructions can be given promptly for the cancelling of trains in cases of insufficient Traffic or the running of Specials to meet unforeseen surplus. In the event of congestion arrangements can be at once made to divert freight traffic by alternative routes to the less affected yards and sidings. At present on the South Indian Railway the prevailing view is that the Controllers on the whole have no initiative and are led by the Stations. This is due to the fact that the whole work on South Indian Railway was concentrated at the top to suit a Ex-Company Management. This tangle had to be solved. The late Mr. Philip Burtt, formerly Deputy General Manager of the North Eastern Railway in England, in his authoritative and comprehensive work "Control on the Railways" reviews the effect of traffic control upon signalman, Gaurds, Enginemen, Station Masters and Yard Masters. Regarded in the right spirit, he believes that the exchange of mind between Controller and Local Agents must increase the knowledge and efficient of both parties, but insists that devolution rather than concentration of responsibilities is the true principle to apply. On this, he is supported by Sir George Findlay, a former General Manager of the London and North Western Railway, who, writing many years ago, said "In fact, the secret of organising a great service such as a great Railway system is nothing more than a carefully arranged system of devolution combined with watchful supervision." Since the main objective of regrouping is to stop the upward spiral in the operating costs, we must use all the ingenuity we can devise and command to keep these costs down. Only by reorganising the Controls we can do this. In the search for need and better ways of doing all the things we have to do, we can rely on the present Heads of Departments and Staff must give their unstinted cooperation.

Nizam State Railway News Letter

By Our Correspondent

PASSENGER AMENITIES

AS an experimental measure, a temporary Ice Cream Stall has been opened at the Secunderabad Station. The stall is situated on the main Broad Gauge No. 1 platform.

During the hot season, ice and aerated waters are on sale on all important Express and Passenger trains at special reduced rates.

Permanent water shelters for storing cool drinking water in pots have been constructed at the following stations on the NSR :—

Gadwal	Devarkadra	Mahbubabad
Jadcherla	Wanaparthi Road	and
Veludrti	Mahbubnagar	Madira
Shadnagar	Dornakal	

During June the construction of water shelters on the platforms at Bhongir, Raigir and Alir has been completed.

At Secunderabad a Water Cooler has been installed on the metere gauge suburban platform for the convenience of passengers travelling by suburban trains.

The pavement of Sitafalmandi suburban platform with Shahabad stones has also been completed.

During the last week of May the Railway constructed about 20 Units Type "A" quarters at North Lallaguda for the use of the Staff of the Locomotive department. Also at Secunderabad Rifle Range the Administration has completed the construction of 27 units of type "A" quarters during the second week of May for the use of Relieving and Emergency Duty staff of the Traffic Department. Already in April the Administration had completed the construction of 15 units of type "A" quarters at Secunderabad Rifle Range and another 15 units at Lallaguda.

For the convenience of the families of Railway Staff, arrangements have been made to provide a separate out-patient department at the Lallaguda Railway Hospital for the exclusive use of women and children with a Lady Assistant Surgeon in charge.

Besides, at the Hospital managed by the NSR a Cardiograph apparatus for taking electric cardiogram has been added to the medical equipment of the hospital during year. A portable X-Ray machine, Anaesthetic apparatus of latest type and design and an Inductotherm and a Cardioscribe have also been installed.

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As a result of the ventilation of the grievances of the NSR Staff working at Secunderabad in connection with the opening of V Form at the Railway School, Lallaguda both in the columns of the "*Southern Railways Magazine*" and also as a result of the representations made by a Hyderabad Member of the Parliament, the President of the Republic Dr. Rajendra Prasad has kindly accorded sanction for the opening of V Form at the Railway School from June 1951 and

appropriate arrangements have been made by the administration.

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The NSR Union is conducting the 'strike ballot' very briskly throughout the Railway through its 12 branches and 16-man-action committee in accordance with the directive of the All-India Railway Men's Federation. Several thousands of railway workers have participated in this voting and the results are due on June 10 or 11 1951. The voting started on May 29 and ended on June 9.

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The family of the victim at the engine burst on January 27 near Seram in the NSR system, has not yet been paid any compensation, it is learnt. There has been persistent agitation in the Union circles for the payment of adequate compensation to the engine crew who died on duty as a result of the accident. It was contended on behalf of Workers' Union of the Railway that the accident was not entirely due to any unexpected mishap and that the engine had troubles previously and had not some of the equipments for reading the pressure etc.

The NSR Employees' Union demanded representation at the enquiry into the incident by the Government Inspector of Railways but the demand was rejected and the Union was only permitted to send one or two observers. The findings of the Government Inspector for Railways are not yet known.

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The dispute arising out of the reinstatement of an Assistant Foreman, RTD Workshops, NSR, between the RTD workers and the NSR Administration has again come in the forefront.

The workers staged a tool-down-strike thrice in this connexion and resumed work.

It appears that Mr. Tyagarajan, an Assistant Foreman in the RTD workshops was alleged to have removed some stores like grease, soap etc. from the workshops and that he was detained at the gate by the Watch and Ward Staff and examined. In the search, it was alleged, the Watch and Ward staff recovered these stores. Pending a thorough enquiry he was suspended for some time and later on, the enquiry resulted in the reinstatement of the employee as the NSR General Manager came to the conclusion that Mr. Tyagarajan was not guilty of any charge and that he had produced receipts for the stores which he had purchased from local bazaar and which he was carrying on the day in question.

Against this finding of the General Manager, the workers of the RTD workshops went on a tool-down-strike and after assurances that it would be referred to the Conciliation Officer, Labour Ministry, Government of India, Secunderabad, they resumed work.

Later when the workers came to know the scope of the enquiry by the Conciliation Officer was reduced to a considerable extent and that he had to conduct his enquiry only on the basis of the evidence and documents, the General Manager would place at his disposal, the workers agitated and demanded an impartial judicial enquiry into the matter.

The Administration turned down this request and the workers referred the issue to the Railway Board demanding a judicial enquiry into the conduct of the Assistant Foreman and a reply from the Railway Board is still awaited.

Meanwhile RTD workers have stiffened their agitation in this

behalf and another strike seems to be imminent.

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During the year 1951-52 the N. S. Railway have made provision for a sum of Rs. 8 lakhs in their annual budget towards expenditure on Labour Welfare Work. Of this sum, rupees six lakhs is earmarked to be spent on the construction of some 275 staff quarters for the Railway staff, while the balance will be spent on water supply, drainage provision and improvement of electric lights in Railway Colonies, additions and alterations to Railway Schools, Hospitals and Institutes, the provision of a shelter for Running Shed Staff and Canteens and Tea stalls for workshop and office staff.

There have been frequent Complaints in the Hyderabad Press in regard to passengers travelling in RTD buses who object to smoking. They have also drawn the attention of the NSR authorities that Conductors should be instructed to prevent passengers in bus from smoking.

The NSR Administration have said in their notification on the subject that they have no power to ban smoking in buses and that it is a matter for the State Government to intervene. However, certain seats marked "S" have been allotted in the buses for the passengers who want to smoke while travelling in buses. They have also appealed to passengers taking seats not marked "S" to refrain from smoking and thus avoid annoyance and inconvenience to non-smokers.

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In accordance with the instructions issued by the Railway Board, a Standing Screening Committee (Inventions and Suggestions) has been appointed by the General Manager consisting of the following Officers :—

1. Chief Mechanical Engineer.
2. Deputy Chief Engineer.
3. Road Transport Superintendent.
4. Electrical Engineer.
5. Personnel Officer (Secretary of the Committee)

The Committee meets every month and its functions are to examine all suggestions and inventions received from Railway staff and others and to make recommendations to the General Manager if a reward is proposed to be given.

Any member of the staff is permitted to send in his suggestion or invention either directly to the Secretary of the Committee or through the head of his department or district. Where necessary the Committee will give an opportunity to the inventor of explaining his idea personally. In all cases where the suggestions or inventions are not considered practical or suitable for adoption on the Railway the conclusion and the reasons for it will be conveyed to the inventor who, if he desires to clarify his ideas further, may do so.

The following rewards have so far been sanctioned by the General Manager on the recommendations of the Standing Screening Committee :—

(1) A reward of Rs. 500 in February 1951 to Mr. Mariadass, Mechanic RTD for his invention of a modification to the Fuel Injector Pump Element.

(2) A reward of Rs. 500 in April 1951 to Mr. E. Satyanarayana, Fitting Shop Chargeman, Engineering Workshops for his invention of a "Square Screw Washer" for Fishbolts.

Railways Built for Fun

By C. H. Gates-Reed, M. I. A. M. A.

EVEN though you might be lucky enough to travel extensively on the very extensive network of Railways in the U. S. A., it is unlikely you will ride the mile long track of the Byron Railroad. Unless of course, you end up in Creston, Iowa ; then you are bound to hear about it and wish to join the many thousands who go for the fun of a trip on this unique Railroad.

Only a mile of track, you ask ? Well, this is a special Railroad, a oneman effort ; the whole thing, including two fourteen ton, eight foot high, thirty foot long locomotives being the spare time handiwork of a plumber who has spent seventeen years and many thousands of dollars on his hobby train.

Unlike most Railway pioneers Byron P. Hiatt built his rolling stock first ; the locomotives are a hotch-potch of mixed parts ; one engine boiler was once part of a threshing machine, the other had been used in a creamery. But by the time plumber Hiatt had finished with them they were very realistic indeed to look at and in their ability to heave his train when once he had laid the track. Incidentally, on a full working day, over the week ends, when visitors are allowed to be passengers for a small charge, his locomotives require 800 gallons of water.

The rolling stock was adapted from a group of substandard carriages used for Railway publicity purposes ; a mail car, a passenger coach and two freight cars. Having started the project in 1933, when he was a railroad pipe fitter, nine years later Hiatt was ready to lay his track.

He invested in a ten acre estate and set about killing two birds with one stone—i. e. building a house for his family and getting the Byron Railroad into operation. It took him six years altogether but then the track includes an eighty foot trestle bridge, the pilings set in cement, a seventy foot bridge of re-inforced steel, switches and signals, and a phoney set of telegraph poles and wires for the sake of atmosphere.

Today, visitors can also enjoy the fun of Hiatt's hobby for the small charge of fourteen cents a trip (25 cents to travel with the driver)—and there is an amusement park also. The popularity of the Byron Railroad has reduced Hiatts' working week as a plumber to four days. The rest of the time is devoted to his railway built for fun.

FAR TOTTERING AND OYSTER CREEK

Before the Festival of Britain is over we are going to see and hear a great deal of the famous Emett Railway, and inspired feature of the Festival Gardens, Battersea Park, London. All readers of PUNCH will remember with amused affection, the fantastic locomotive "Nellie" which draws the coaches—very remarkable coaches indeed—of the Far Tottering and Oyster Creek Railway. The Tourist's Special, complete with 'That 01' Back Porch ' observation car, will carry passengers excursions, by courtesy of R. V. Emett, the artist, into his weird never—never—land of

spindly legged gentlemen, Cloud—Cuckoo Valley, Wisteria Halt (very suburban) Smugglers Point et al. It is doubtful whether any artist has succeeded as Emett has done in building up and sustaining interest among adults in such a complete fairyland of whimsey humour. The far Tottering, "Nellie" drawings have appeared in Punch almost weekly for years. This very-much-working-model, of brass, copper domes, wires, wonderfully ancient lamps, bells, and birds' nests where birds nests should never be, is a great and telling tribute to his very individual brand of fun.

It is estimated that when the railway engineers have overcome the fantastic difficulties of making working trains from unworkable drawings, some 10,000 people a day will get the fun of their lives by taking a trip—2½ minutes to cover 1,600 feet—on the Far Tottering and Oyster Creek Railway. And "beware of Stygian Halt where nobody much cares to after four O'clock in the afternoon", and the darkness of the 140 food tunnel.

See you at the fair then !

Death which is an eternal verity is revolution as birth and after is slow and steady evolution. Death is as necessary for man's growth as life itself.
—M. K. GANDHI

I do not want to be reborn. But if I have to be reborn, I should be born an untouchable so that I may share their sorrows, sufferings and the affronts levelled at them in order that I may endeavour to free myself and them from that miserable condition.—M. K. GANDHI

Your Magazine

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Our London Letter

By a Correspondent

THE Festival of Britain is now in full swing and at the south site in London transport is well represented in all its phases. There are three British Railways Locomotives utilising steam, electric and diesel electric power respectively. The steam loco is one of the new standard "Pacifics" which was described in a previous issue. The electric locomotive is one of the 0-6-6-0 type which are being built for the Sheffield-Manchester main line electrification. The diesel electric loco is one of 1,600 h. p. built in the Ashford shops of Southern region for use on Express Passenger Trains.

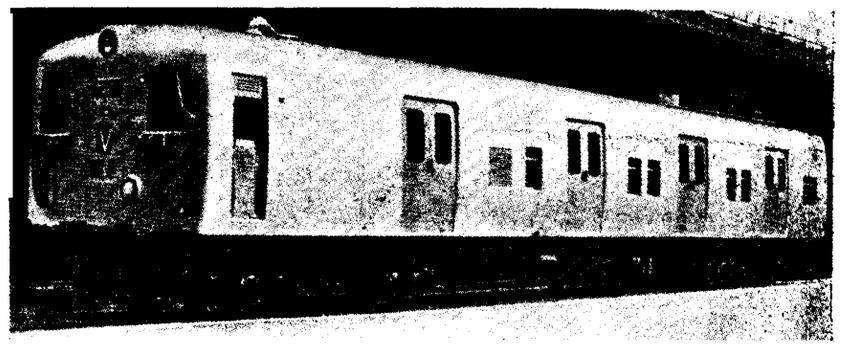
A feature of the transport exhibits is the 2-2-2 Buddicom Passenger Locomotive which has been lent by France. This locomotive was built by Allcard, Buddicom and Co. at Chartreux, near Rouen, in the early 1840's and is still in running order while its equally famous contemporary the Crampton, achieved its greatest fame only in France, the Buddicom was to be found during the last part of that century in Italy, Spain, France, Canada, etc. In Great Britain it was also a favourite being known as the Crewe type. Three men were responsible for the wide use of the type overseas. They were Joseph Locke, one of the great Railway Civil Engineers who designed Railways in France, Spain and elsewhere; Thomas Brassey, one of the greatest figures among Public Works Contractors and William Barber Buddicom, at one time Locomotive Superintendent of the Grand Junction Railway. These are but a few of the many exhibits displaying all branches of transport the largest and latest of which is a huge "WG" class 2-8-2 locomotive for the Indian Government Railways.

One railway in the U. K. will prove a great attraction in the "Festival of Britain" year and that is the unique Romney, Hythe and Dymchurch Railway. It is one of the smallest public railways in the world being only 14 miles long and 15 inch gauge. It has, however, powerful modern steam locomotives, one third full size replicas and it has de luxe Pullman passenger cars. This unique line, opened 25 years ago is a complete railway system in miniature with elaborate track, signals, stations etc. The steam locomotives include miniature Pacifics of great power, some based on British and others of Canadian design. One of the crack trains on the system is the "Blue-coaster Limited" running non-stop between Dungeness and Hythe (14 miles). The train is made up of attractive blue and primrose Pullman cars just over 16 feet long. 3 ft. 6ins. wide and 4 ft. 8 in. high. The management of the railway are preparing to handle record business this year.

Euston Station, the London terminal of the London Midland Region is to be remodelled at a cost of £300,000. This famous station, with its Doric archway, was planned by Robert Stephenson and the architectural work was superintended by Philip Hardwick, one of the noted architects of the time. It was opened to the public on July 20 1837. The present improvements will take about two years to complete. A new power operated signal box with colour light signalling and complete track circuiting will replace the existing three manual boxes. Position

Mr. Thomas Crampton's locomotive famous on the Continent in 1850. They were a source of wonderment to the French. Few were built for use in Britain. The illustration shows the giant London and North Western locomotive "Liverpool" with 8 feet driving wheels. This was shown at the 1851 exhibition. (By courtesy of G. D. Peters Ltd.)

The Buddicom 2—2—2 Locomotive



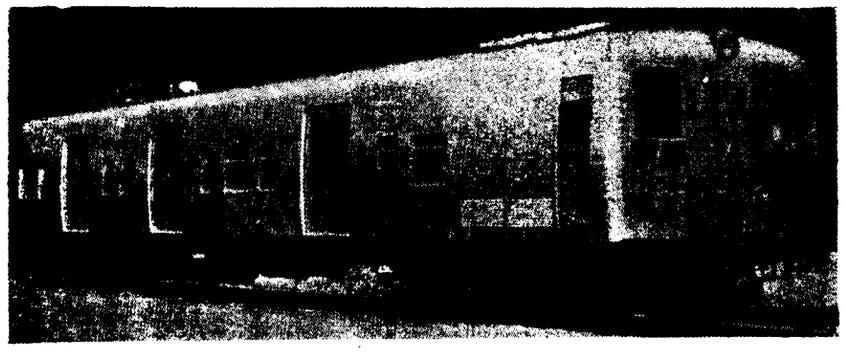
Another view of new motor coach for G. I. P. and B. B. and C. I. Suburban Services.

Interior of new British Railways new standard Dining Car

light dwarf shunt signals will control all shunting movements. The existing permanent way lay-out contains 18 diamond crossings eleven of which have slips. There are also many sharp curves. The pulling down of an overbridge which has long been an obstruction to development, will enable curves to be improved and platforms to be lengthened.

The Metropolitan-Cammel Carriage & Wagon Co. Ltd. of Saltley, Birmingham, is building driving motor coaches for multiple unit electric rolling stock for use on the suburban routes of the Great Indian Peninsular Railway and the Bombay, Baroda and Central India Railway. Messrs. Rendel, Palmer & Tritton are the consulting engineers for the mechanical equipment and Messrs. Merz and McLellan for electric equipment which is designed and supplied by the English Electric Co. Ltd. and the British Thomson Houston Co. Ltd.

A total number of 28 units will be supplied each of four



First of new type of motor coach received for G. I. P. and B. B. and C. I. Railways

coaches consisting of two trailers and two motor coaches. These units are designed for coupling up into eight and twelve coach trains. Particular attention has been given to weight saving, the driving coaches now weighing approximately 51·8 tons a saving of over 18·3 tons on the previous design of multiple unit stock originally supplied to these railways.

Access to the coaches, which are of the open saloon type, is by means of double sliding doors. These will be manually operated in the first place but provision has been made for conversion to power operation. The coaches are 68 feet long and have a maximum speed of 65 m. p. h. One unit will seat 415 passengers but will carry 772 in crush periods. For monsoon running the stock is specially designed to run through flood water 8 ins. above the rails at 5 m. p. h. The traction gear is waterproof to a height of 39 ins. above the rails. Westinghouse electropneumatic brakes are provided.

The Giant's Causeway Tramway in Co. Antrim, Northern Ireland, has been sold for £11,600. This line was one of the first electric tramways or one of the first examples of electric traction in the world and was opened in January 1883 by Lord Spencer the then Lord Lieutenant of Ireland. The railway was of 3 ft. gauge and connected Portrush and Bushmills a length of about 8 miles. The railway had 8 motor coaches and 18 trailers. The overhead system of current collection was in use though originally a conductor rail was used. Power was generated on the hydro electric principle the first installation of this type in the world.

The "Lion on the wheel" symbol is the emblem or crest now used to denote nationalised British transport. It was designed by Mr. Cecil Thomas, the Chelsea sculptor. The crest of the London Midland and Scottish Railway, was designed by a school girl. Sir Arthur Watson was then General Manager of that line and he had a pretty daughter, Grace, who was at an art school. Hearing he wanted a crest, she designed one in a few hours and presented it to him. It adorned the L. M. S. rolling stock for 26 years.

Some months ago the Canadian National Railways lost a saloon. This caused consternation because it was being used by Mr. Donald Gordon, the President of the Railway. Mr. Gordon arrived in his saloon for meetings of the Canadian section of the European Economics Rehabilitation Committee. After he detrained, the coach was uncoupled from the regular Toronto Montreal train and removed to be turned round for the return journey.

When he returned later in the afternoon, the carriage was nowhere to be seen and the railway employees were completely mystified about it. Before things got too bad a dispatcher dashed up with the information that the coach had been taken 26 miles away for its turnaround but on the return journey the engine failed causing a delay of four hours. The saloon returned just in time for the President's dinner!

What a comforting thought it is to think of death, whenever it comes, as a wise plan in the economy of nature? If we could realize this law of our being and be prepared for death as a welcome friend and deliverer, we should cease to engage in the frantic struggle for life. We shall cease to want to live at the cost of other lives and in contempt of all considerations of humanity.
—M. K. GANDHI

Censure is the tax a man pays to alike.—BURTON

The Railway Industry

By Argus

THE first question that every student of transportation must answer in his own mind is "What is a Railway?".

To the Engineer, a Railway is a physical plant consisting of track, bridges, buildings, carriages and locomotives. His function is to create that plant and maintain it. His vision does not extend beyond this.

To the operating man, a railway is a production machine and the product on capacity of the physical plant is expressed in terms of ton miles and passenger miles.

Though it is a production machine for the traffic man he views it differently from that of the operating officer. To him the plant is not so important so long as it functions efficiently. He is largely interested in the raw material—the traffic which enters into the production of transportation.

The lawyer views the railway in terms of its relationships. His main duty is to interpret the relationship of the carrier to the consignor, passenger, other railways and others with whom the carrier has entered into agreements.

To the accountant a railway cannot be defined separately in terms of the physical plant, its production or relationships. To him it is all inclusive. It includes each of these factors and many others.

To the accountant a railway is a physical plant made up of track, bridges, buildings and rolling stock which must be constructed, acquired and maintained economically. The railway as a production machine must turn out ton-miles and passenger-miles with a minimum cost and maximum efficiency. It is a complex human organization consisting of a highly sensitive personnel comprised of officers, employees and security holders who are held together by bonds of common interest which should be clearly defined and properly safeguarded. The numerous contracts of the railway as a corporate body must be separately defined and recorded. Finally it is a governmental agency exercising certain governmental functions under close governmental control.

The accountant keeps the records and accounts of the original constructions costs. His records are the only measuring rod as to whether a railway is adequately maintained and operated economically. His figures and analysis show the quantity and quality of the transportation produced. The regulation of fares and rates is primarily based on the information collected and furnished by him.

II

MEANING OF TRANSPORTATION

The conveyance of persons and property from one place to another is called transportation.

The two elements of transportation are :—

1. The transportation agencies and

2. The transportation service.

The four important transportation agencies are : 1. Railways 2. Highways 3. Airways and 4. Waterways.

The Railway is the most important of these. The preeminence of the railway as a transportation medium is due to the large amount invested in the physical property, the high percentage of passenger and goods business handled and the large number of employees required to operate the property.

A study of the Railway as a transportation agency, is a study of its physical plant. It inculudes a study of :—

1. The construction and maintenance of property.

2. The administration and operation of the property.

The construction and maintenance of property is an engineering feature of the railway business i. e. how the road-bed and track are constructed and maintained, the principles of locomotive building and carriage designing and the construction of and maintenance of all appurtenances connected with the operation of the property, including signals, telegraph and telephone, buildings, bridges and tunnels.

The administration and operating of the property includes not only the actual transportation operations such as the running of trains but also the financing and larger problems of management.

"Transportation service is the result of transportation and the product of transportation agencies." A study of it involves a knowledge of what the service consists of, what it accomplishes and the factors that influence it such as the relations between the carrier and the consumer of transportation and the relationship of the carrier to the state. This study is, therefore, known as the economics of transportation as compared with the technique of transportation when referring to the transportation agencies.

Railway accounting as a specific transportation study cannot be confined to either of these groups as it is all embracing. Engineering or any branch of it relates entirely to the construction and maintenance of property. The traffic study is largely a study of the transportation service. But accounting is intimately related to every phase of the railway industry.

Accounting will develop the cost of construction, maintenance and operation. It will indicate whether the property is adequately maintained and economically operated. It records facts that are vitally required to the administration of the property. It will show the financial results of the service given and the reasonableness of the charges levied. It measures the amount of service given and furnish facts that will be useful in regulating the carrier's relationship with passengers, consignors and consignees.

III

THE TRANSPORTATION SERVICE OF A RAILWAY

The two primary objects of a Railway are the furnishing of adequte transportation service to the public and to earn a reasonable return on the amount invested in the business.

In earning a reasonable return on the amount invested or in providing the service to the public a railway perofrms only one function viz., it manufactures and sells transportation service. It carries passengers and goods from one place to another for hire. It deals only in this one commodity—transportation.

A railway performs a number of other functions but they are all subordinate to this main function. For instance it may operate a string of hotels but it does so largely to attract traffic and meet the needs of passengers. For the latter purpose it also runs a dining car service. It also performs the functions of an educational institution training its employees to perform certain necessary duties. This is done to render a better class of transportation service.

The four main factors that make up the public service nature of the transportation service are :—

1. Distance carried.
2. The time taken — the speed.
3. The quality of the service including such factors as safety and comfort of passengers, the prevention of loss and damage to goods, punctuality of trains etc.
4. Cost to the passenger and consignor which naturally involve economy of operation.

These four factors—distance, speed, quality and cost are the major elements that decide the efficiency of transportation from the stand point of public service.

"A rail-road company in contracting to transport freight or passengers between two points agrees to deliver them at their destination in the same condition as received and it agrees to deliver them promptly and without undue delay or annoyance."

It is this service for which the consignor and passenger pay for and it is what they expect. Transportation is nothing tangible. It cannot be grasped in hand, looked at, or admired. If a man pays Rs. 300 and buys a cycle he has something. He can have it in his house, admire it and use it for some years. He has received something for money.

Not so with transportation. A man may pay Rs. 300 towards freight charges or pay Rs. 50 for a ticket and after the goods are moved or the ticket used he has nothing to show for it. His goods are in a different place and he is in a different locality and that is the end of the transportation. He bought transportation service which consisted in moving his goods without loss or damage, in carrying his person without injury and the least amount of inconvenience and doing it promptly and for a reasonable price.

Perhaps there has been a word picture so vividly drawn and so descriptive of what railway service is as that painted by R. H. Aishton, President of the American Railway Association in one of his address. His remarks are classic :—

"Just recently I met a train at one of the large terminals in Chicago. According to schedule, it was due to arrive at thirty minutes past nine. I was down at the station well ahead of time, when a large indicator informed me, as well as others, that this particular train would arrive on track No. 5 "On time." The indicator showed that the train was coming from San Francisco, Sacramento, Salt Lake City, Dover and Omaha.

At twenty-eight minutes past nine, the spidery finger of the telauto-graph began to make hieroglyphics on the sheet of paper. In another minute a line of "red caps" formed and the gates opened, just as the great engine was seen rounding the curve at the far end of the station platform, with its burden of 1025 tons of steel cars carrying their human freight. It came to rest at nine-thirty on the dot, with the triumphant air of a conqueror.

I could not help thinking what a symbol of American efficiency that was. For three days and three nights that train had served hundreds of people, not only with transportation, but with their meals and lodging; had attended to their comfort and pleasure as it traversed the length and breadth of eight sovereign states; had crossed arms of the sea, broad rivers and mountain ranges; had plunged through the darkness of tunnels; had hurried through scores of cities, towns and villages. Its presence had been signalled from and to I know not how many lonely cabins, towers, and offices, and here it was, on the tick, riding in its stately way up to the bumpers, its long journey over.

One other thing I noticed that appeared to me even more striking than the manner of its arrival. This was the fact that everybody took this achievement for granted and nobody seemed to think it remarkable. Passengers got out of their cars, seized their luggage, greeted their friends, hailed their taxis, with never a glance at the locomotive, cars or the personnel who had been at their service; and it remained for me, who had some knowledge of what had rendered this performance possible to take off my hat, metaphorically speaking, to the men, from the executive, who planned the system, to the multitude of workers, who had to operate this wonderful machine of Railway traffic.

Think first of the foresight and planning that had to go to the arrangement of that run, so that the train might have a clear course over approximately 2,261 miles of line, with its numerous intersections and junctions. Think of the mechanical ingenuity that had to be applied to insure its safety and smoothness. How many eyes had to watch lest there be the slightest deviation to threaten catastrophe! How many gates had to be opened, levers pulled, messages telegraphed ahead, other trains got into the clear in time to afford this train clear passage.

And then consider that this is only one of many trains on this individual system every day and that through the length and breadth of this country the same thing is going on, back and forth like the shuttle of a loom, all day and all night, week days as well as holidays; Sundays as well as week days; and then think that all this is the result of a type of organisation, reaching down to every axle and bearing, such as would make any of the great battles of history appear like the efforts of amateurs in comparison."

A Railway is a commercialised business organised for profit.

As long as the Railways are privately owned the object of the transportation business will be profit. Their chief function will be to see transportation to create this profit for no Railway can operate without profit. All other activities are subordinate to this.

The factors that go to determine the value of a carrier as a money-making plant are numerous. Primarily these include the factors that show the volume of traffic handled and the indices denoting operating efficiency.

The factors that indicate the volume of traffic handled are the passengers carried, tonnage hauled, wagons loaded train and wagon mileage and revenue received per traffic unit.

Among the important units that indicate the operating efficiency of a railway are the following :—

1. Vehicle miles
2. Gross tons per goods train
3. Net tons per goods train
4. Gross ton-miles per goods train hour
5. Net ton-miles per goods train hour
6. Locomotive miles per locomotive day
7. Percentage of serviceable locomotives
8. Fuel consumption per unit
9. Goods train-miles per hour
10. Vehicle shortages
11. Ton-miles per vehicle day
12. Percentage of serviceable wagons

(*Continued on next page bottom*)

The Railways of New Zealand

Outstanding Engineering Works

By A Correspondent

THE Dominion of New Zealand is composed of three islands, North Island, South Island, and Stewart Island. Railways have been built on North and South but there are none on Stewart Island. The strip of water between this Island and South Island is very famous for its Oysters.

Railway construction began in 1863 when three miles of 5 ft. 6 ins. gauge railway was opened. Various separate railways were built sponsored by different organisations but today the whole railway system is run by the New Zealand Government and also the steam ferry service from Wellington terminal on North Island to Christchurch on South Island. The largest of these steamers is 6,000 tons and they are luxuriously fitted.

The main line on North Island runs from the terminal at Wellington to Aukland, far awy in the Northernmost peninsular beyond the Hauraki Gulf. On this run some 50 miles of track are carried 2000 feet above sea level with viaducts 200 and 300 feet high. Summit level is at Waioutu, reached after some remarkable spiral track construction, 2,659 feet above sea level.

3 feet 6 ins. is the standard gauge adopted by the New Zealand Railways. The average rail weightage is 70 lbs. per yd. but lighter sections are used on branch lines. Recent works approaching Wellington and Christchurch terminals have 100 lbs. section rails. New Zealand is noted for its mountains which occupy most of the islands except for small stretches of plain near the coast. This occasioned very heavy railway engineering works on account of grades, the bridging of wide rivers, fed from mountain glaciers and the boring of tunnels. The 3 ft. 6 in. gauge permitted sharper curves to be used, clinging to the mountain sides.

A formidable piece of engineering work is the crossing of the Rimutaka mountains. This line runs from Wellington to the Wairarapa plains the most prosperous sheep farming and dairy area in the dominion. The Rimutaka mountains run right across the path to these plains. 34 miles from Wellington, Cross Creek Station is reached situated in the valley wich ascends steeply into the heart of this range. The next 2½ miles beyond this point the line ascends 871 feet with continuous grades of from 1 in 16 to 1 in. 13 with sharp curves of 330 feet radius.

It was not possible to use adhesion traction for reasonable loads and the Fell system is employed. This uses a centre rail of the bull head type but lying on its side. In addition to the ordinary wheels, the locomotives are provided with horizontal wheels which grip each side of the centre rail. These wheels have coarse steel flat treads held in position by powerful springs. They can be swung clear of the rails when they are no longer required. Light weight locomotives are employed weighing only 39 tons. They are the 0—4—2 type having 2 ft. 8 ins. diam. cylinders with 16 in. stroke. They also have two internal cylinders 12 in. diam. by 16 in. stroke. These drive two vertical axles and by means of pinions the motion is transmitted to the gripping wheels for the centre rail.

Special brakes are used on this section. Four cast iron brakes are worked by a screw motion gripping each side of the centre rail. In addition to this, each train must be made up of a certain number of Fell brake vans. Each van is manned by a guard who, by means of a hand wheel, forces additional brake shoes against the centre rail and so assists in the control of the trains when the descent is being made.

It is also important, in ascending, that too severe a strain shall not be put on the couplings connecting the coaches. The trains are arranged so that each locomotive shall be pulling the load for which it is designed. This is usually 60 tons of passenger stock or 65 tons of freight. Trains up to 260 tons are worked up the incline which means that every train arriving at the foot has to be remarshalled.

In the case of passenger trains, a Fell locomotive comes at the head, then two bogie coaches, another locomotive, then two or three more coaches and so on. Several Fell brake vans bring up the rear. A complete train, if of the full weight, may have up to four locomotives distributed throughout its length. When descending the incline the brake vans are even more important than the locomotives. A 260 ton train must contain at least five brake vans and two locomotives. On this account, a certain amount of light running between engines and brake vans must take place. Speeds are restricted to six miles an hour ascending and ten miles an hour descending.

The Rimutaka section is a formidable restriction to the working of this portion of the line. It takes 15 mins. to marshall the trains at Cross Street and a quarter of an hour to re-arrange them at the summit while the climb takes

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The activities of a carrier are so widespread and the departmental functions so specialised that several units of the organisation often look upon their particular work as the essence of the business.

A bridge is built, a track is laid, a train is run, a report is made, not as a monument of engineering skill or as a demonstration of operating efficiency or as a matter of mere information but for creating and bettering the grade of transportation sold in order to earn greater profit. Every activity is correlated with this and no activity can be said to be more important or more essential than the other in creating the quality at which the transportation service is aimed. They are all necessary.

The gangman who maintains that line is just as truly a railway-man as the driver who drives the engine. The accountant in the office is as necessary as the guard who handles the train. Every Railway-man has his niche in the great game of transportation.

But it is a characteristic of the business that financial success can only come with adequate public service. The earning capacity of the carrier is dependent upon the service it renders.

Every Railway employee should grasp these two fundamental principles of Railway operation. They will make him understand his own duties better; his relative importance in the function of transportation; and above all it will give him a knowledge of the character of service that is expected of him—the key to his own personal success.

forty minutes. With the advance of motor coach traffic this latter form of transport became a serious competiton. This was countered by the railways by lowering the fares and making them less than those charged by the motor coach proprietors.

Plans have been under consideration for some time for a diversion to cut out this steep incline. Even taking into consideration the extra number of engines, brake vans and crews necessary for working the incline the saving was barely sufficient to pay the interest on the capital cost of the proposed work. Experiments are in hand for the use of rail cars on this grade. Meanwhile the New Zealand Government Railways can boast that they work the heaviest trains in the world over a gradient of 1 in 13.

In recent years Wellington Station and harbour have been completely re-modelled. This work involved the reclamation of sixty eight acres of land from the harbour and the building of a new sea wall along the whole of the harbour frontage. On the reclaimed land a large marshalling yard with loading banks and goods sheds has been laid down and all the freight work of the capital is concentrated there.

For the Wellington Station building, a four storey structure 72 feet high, 1400 re-inforced concrete piles were driven into the reclaimed land. Special provision has to be made in New Zealand to guard against earthquake shocks. To provide against this menace, the piles are joined together by continuous ties and for the same reason the steel structure of the building has special jointing. The cost of the new station was £350,000.

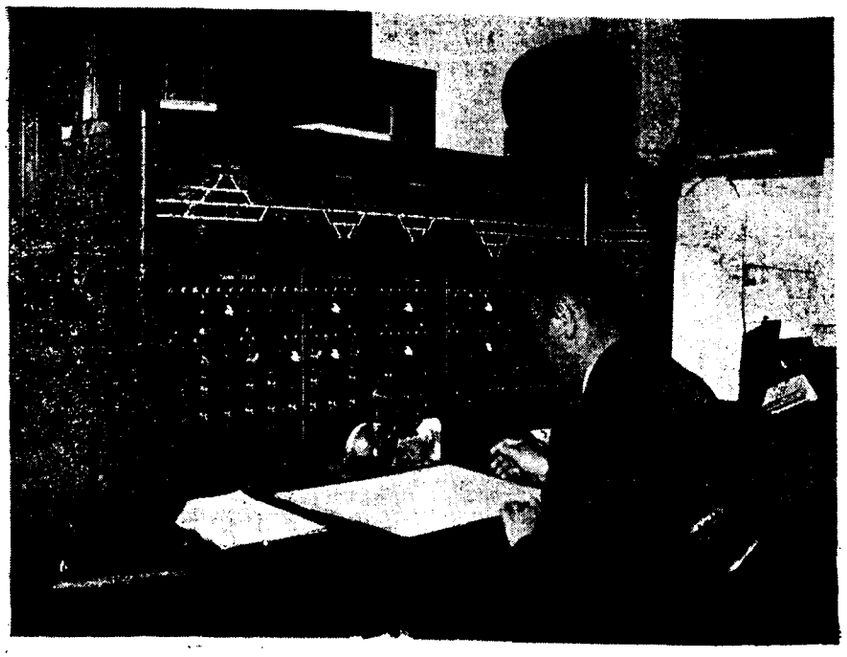
On the North Island Railway Section the "K" Class locomotive is mainly in use. These locomotives are very powerful and their wheel arrangements are 4–8–4 with 8 wheeled tenders. Although the 3 ft. 6 in. gauge permits a maximum height of only 11 ft. 6 ins. above rail level, these engines have 20" by 26" cylinders, 2, 413 sq. ft. of heating surface, 4 ft. 6 ins. driving wheels, 200 lbs. per sq. in. pressure and a tractive effort of 30,815 lbs. The engine and tender are 70 feet in length over buffers and have a total weight of 135½ tons.

The South Island of New Zealand is just as interesting from a railway engineering point of view. The mountain backbone reaches cansiderably higher altitudes. The highest peak on North Island is Ruapehu 9,175 feet while Mount Cook on South Island reaches 12,349 feet above sea level. The West coast with its deep inlet and ice mantled peaks, provides a combination of Norwegian and Alpine scenery which probably has no rival elsewhere.

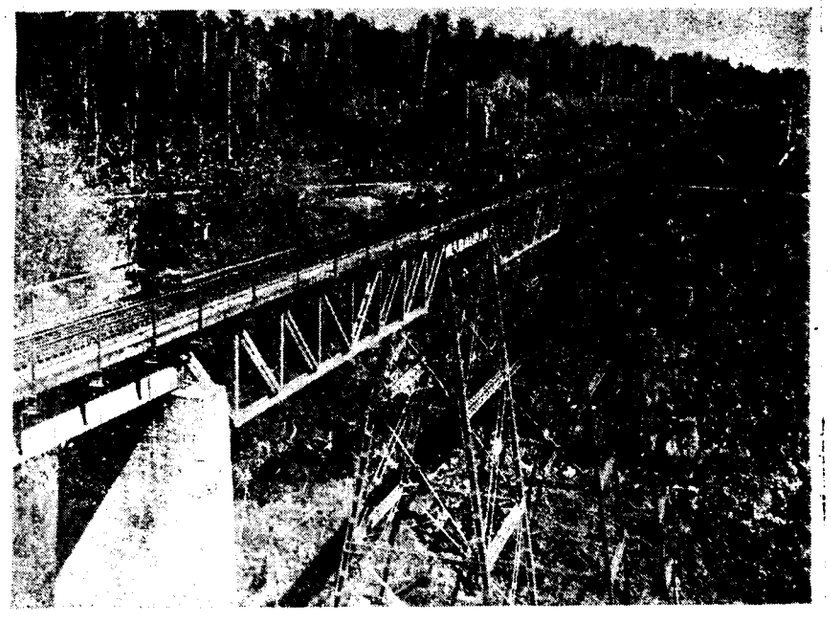
For many years this mountain range provided an almost impassable barrier to railway progress. The main railway system ran along the plains that fringe the East coast and connecting the cities of Christchurch, Dunedin and Invercargill. A smaller system serving Westport, Greymouth and Hokitika ran on the North West coast and the two systems were completely isolated.

In 1923 this isolation was broken by the construction of the Otira tunnel which joined the two lines together. Five and a quarter miles long, it is the longest tunnel in the Commonwealth. It is horseshoe shape in section being 17 feet high and 15 ft. wide. There is a stiff climb from Rolleston Junction to reach the east portal which is 2,435 feet above sea level. Through the tunnel, the line falls steadily

Wellington Railway Station opened in 1937. With nine platforms this station handles 240 passenger trains and 30,000 passengers daily



Centralised Traffic Control panel in the Train Control Office, Wellington



Goods train crossing the Makotote viaduct, Wellington Auckland Railway. The bridge is 260 feet high and 860 feet long.

Wellington bound goods train passing through Petone. The automatic semaphore signals seen in the photo were installed in 1922.

Class "Ed" electric locomotive entering Wellington on the present main line

on a gradient of 1 in 33 emerging at Otira 1,585 feet above sea level. It is dead straight and it is possible to see the pinhole of light which marks the other end.

Owing to the fact that the tunnel is single line and has a severe grade, steam traction could not be adopted because of ventilation difficulties. Electric traction with overhead system of current collection has deen installed. Steam locomotives are detached at each end and electric locomotives used instead. Colour light signalling is used on this section. This tunnel, with the connecting lines and electrification, cost £1,500,000 but the consequent development of the railway system on both sides of the island proved that it was worth it.

The New Zealand Railways have no fewer than 2,472 bridges comprising 10,704 spans equivalent to 48.2 miles. 27 miles of the island's system is carried in tunnels and nine per cent. of the total mileage is steeper than 1 in 50, 19% steeper than 1 in 75 and one quarter steeper than 1 in 100. 6% of the total mileage is curved to a radius of 660 feet or less and 12% to a radius of 99 feet. Just over one quarter of the total mileage is curved. Gradients, curves and gauge limit speed although sixty miles an hour is obtained on the straight sections.

Developments in locomotive construction includes the building of 25 lightweight locomotives of the "Ja" class at Hillside Workshops. These are of the 4—8—2 type. 7 electric locomotives of the Bo-Bo-Bo type are under construction with the English Electric Co. Ltd. in conjunction with Robert Stevenson & Hawthorn's Ltd. for the electrified section in the Wellington area. These are 72 ton triple bogied articulated locomotives of 1,800 h. p. with a tractive effort of 38,000 lbs. In addition to heavy passenger haulage they have been

designed to haul 600 ton through goods trains at 30 m. p. h. on a ruling grade of 1 in 70. Their maximum speed is 60 m. p. h. Fifteen 660 h. p. Bo–Bo diesel electric locomotives are also under construction at the same works and are intended for heavy continuous shunting duties at Wellington and other seaside ports. These locomotives are the first of their type to be used in New Zealand and weigh 52 tons with a tractive effort of 30,000 lbs. Other diesel locomotives of the 0–4–0 and 0–6–0 type are also under construction in Britain.

The Otira–Arthur's pass section, incorporating the unusual combination of a 5¼ miles tunnel with a ruling grade of 1 in 33, has meant the provision of greater engine power. 150 ton four units articulated locomotives capable of ascending the steep grade with a 400 ton load are under design. Multiple unit electric coaches are being received from Britain for use on the Wellington-Paekakariki section to replace the present trains hauled by electric locomotives. The most outstanding feature of these coaches is the improved pattern of bogie made in cast steel in a single unit. These bogies are the first of this design to be produced in Great Britain.

The New Zealand Government Railways, although starting late in history of the world's railways, have a thoroughly up-to-date system. So far as signalliug is concerned many miles of single line is signalled automatically with track circuits and colour light signals. Many sections are also operated by the Centralised Traffic Control system with other sections in course of construction. The rolling stock comprises approximately 650 locomotives, 1,500 coaches and over 25,000 freight vehicles.

Railway Contracts Abroad

By Saroj B. Biswas

The Indian Government Railway has lately placed the following contract :—

(A) Rolling Stock :

1) N. V. Machinenfabrick Du Croo & Brauns, Amsterdam, Holland 1000 Metre Gauge 4 wheeled covered Goods Wagons.

2) Baume & Marpent. S. A. Marpent, Nord, France, 1,750 Metre Gauge 4 wheeled open Goods Wagons, 10 Narrow Gauge bogie rail and timber wagons, 150 Bogie Petrol Tank Wagons.

3) La Brugeoise Et Nicaise Delouve, S. A. Bruges, Belgium 2,000 Metre Gauge 4 wheeled covered Goods Wagons, 100 Narrow Gauge bogie Petrol Tank Wagons.

4) Simmering—Graz—Pauker. A. G. Vienna, 250 Broad Gauge 4 wheeled Petrol tank Wagons.

5) Machinenfabrik Augsburg Nuremberg, Germany, 250 Metre-Gauge 3rd Class steel passenger coaches, 50 bogie hopper wagons 1,000 Metre gauge 4 wheeled covered Goods Wagons, 50 Narrow gauge carriage underframes and bogies.

6) Etablissements Coder, St. Marcel. Marseilles, France, 1,000 Metre gauge 4 wheeled covered Goods Wagons.

(B) Locomotives and Boilers :—

1) Henschel and Sohn. G. M. B. H. Germany 49 "H. S. M." type superheated coal burning boilers for H. S. Class 2—8—0 Goods Locomotive of B. N. Railway.

2) Robert Stephenson and Hawthorns Ltd. England for 30 2—6—4 "W. M." Class Broad Gauge side tank locomotives.

3) Krauss-Maffei A. G., Munich, Germany for 50 Y. P. 4—6—2 Metre Gauge locomotives, 15 ZB 4—6—2, 15 ZE. 2—8—2 & 5 ZF. 2—6—2 type Locomotives for 2′-6″ lines and two other Narrow Gauge Locomotives.

4) North British Locomotive Co. Ltd., Glasgow—100 YP. 4—6—2 Metre Gauge Locomotives. Over and above 150 Metre Gauge Locomotives ear-marked for the S. I. Railway are on orders for Canada and U. S. A. Some leading dimensions of the YP. are as follows :—

1) Cylinders (2)-Dia. and stroke $15\frac{1}{4}'' \times 24''$;

2) Boiler pressure—210 lbs. per sq. inch ;

3) Diameter of the coupled wheels—4′—6″ ;

4) Tractive effort at 85 % B. P.—18 400 lbs.

5) Axle lead—10·55 Tons.

6) Grate area—28 sq. ft.

7) Length over buffers—62′—$7\frac{1}{2}''$;

8) Weight of the Engine and tender in working order—$97\frac{1}{2}$ Tons.

This Locomotive will have double bogie tenders with a bunker capacity for $9\frac{1}{2}$ Tons of coal and a tank capacity of 3,000 Gallons of water.

Already some 20 of these engines are running on the B. B. & C. I. Railway with quite good results. The YC. engine the present heaviest Metre Gauge passenger locomotive with an axle load of 12 Tons is generally restricted to 60 lbs. rails for running, but the YP. engine with a lower axle load is designed for 50 lbs. rails with a greater hauling capacity as the latter develops 1,030 horse-power against 945 h. p. of the former.

Reference :— (1) Overseas Railways—1950. (2) Railway Gazette of Dec. 1 and 8, 1950, January, 12, 19 of 1951, February, 2 of 1951.

Presenting Mr. Railwayman

"The Welfare Inspector"

By A. H. Pearson

A Railwayman on duty, if he is to do his job of work efficiently, is expected to keep his mind and brain on the work in hand; but like all human beings, at odd moments of reverie, the Railwayman will be milling over some problem, domestic or otherwise, that has nothing to do with his job. The problem may be so acute as to make him worried or nervous, and if he is an operating man, this is not only undesirable, but can be at times dangerous. An error of judgment caused by mental anxiety may lead to an accident with disastrous results.

What exactly are these problems? They are common to all men, and women. Mr. Railwayman may have a wife or child seriously ill. This illness needs perhaps specialised medical attention, well beyond his means. Or, he may have a daughter of a marriageable age, and the lack of sufficient funds is holding up the marriage. Now this is where the Welfare Inspector steps in. A lot of Railwaymen, especially those amongst the class IV category, may not be aware that there are Co-operative Loan Societies in his Railway, from which he can obtain the required financial assistance on loan, repayable in easy instalments over three to four years. If the loan is urgently needed the Welfare Inspector, after advising the Railwayman concerned about the preliminaries, will get the loan through promptly.

Then again there is Staff Benefit Fund which assists Railwaymen, especially in cases of serious illness. And this financial assistance is not a loan, but a gift to the Railwayman, so that whichever member of his family is in urgent need, he can get the money to procure the medical treatment needed. Once again, it is the Welfare Inspector who comes in with his advice and assistance.

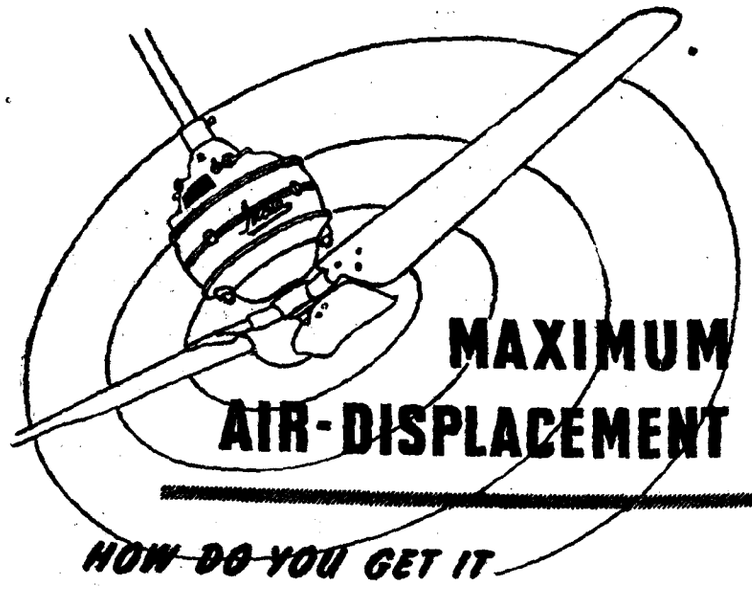
Now take the case of large concentrations of Staff, like workshop centres, divisional headquarters offices and so on. The men working at these centres may have come a long way from their homes, and have to work their seven or eight-hour day on the odd titbits of food they bring with them, or go hungry till they get home again. The Welfare Inspector is on the job. What is the answer to help feed the hungry man? Staff canteens. Within a short time a canteen committee is formed, with representative members of various grades and categories of staff, and they formulate the plans for initiating the staff canteen. When all details have been completed, accommodation and appurtenances, etc. for the canteen secured, the Welfare man reports to headquarters with the whole scheme, and before long the canteen comes into being, where the hungry Railwayman can get anything from a hot refreshing 'cup o' cha' to a good wholesome meal, at a cost much below the current market rates. Even when the canteen is in full swing, the Welfare Inspector must keep almost an 'housewifely' eye on its activities with a view to avoiding complaints from sraff, and effecting improvements.

There are thousands of Railwaymen, amongst the class IV staff, the labourers, semi-skilled and so on, who have never had the advantage even of a little primary schooling. These men do not know how to read or write. Perhaps some of them may know enough of the three 'R's' to do simple addition sums and sign their names on their paysheets. A scheme has now been in force on all Railways to provide adult schools, so that these Railwaymen can at least be taught to read and write in their respective mother tongues. The Welfare Inspector now comes along, collects facts and figures of illiteracy at stations where there are large numbers of staff, also note their reactions to the facility to be provided, and if he finds the response is eager for education, he will send his proposals to headquarters. And this is how an adult school is born. Soon you will see these Railwaymen, from the teen-ager cleaner or Second fireman, to grizzled, middle-aged old stagers at their desks, eager to learn the three "R's."

Railwaymen must work, but they also play. After the day's work is done, they do not merely sit at home, mooning around. Each has a liking for a particular from of play or recreation. And where does he, and his family, get this? From his Institutes and Recreation Clubs. At the larger stations on Railways, where there is a big railway colony, there is always to be found one, or even two Institutes. These provide recreation in many forms. Books for those who like reading, indoor games like carrom, draughts, cards, etc. outdoor games and sports like football, hockey, badminton, volley-ball, And last but not least, at the large workshop and divisional headquarter centres, the Institutes are also equipped with cinemas where the Railwayman and his family can see the best in the way of films produced in India, England and the famed Hollywood. But what has the Welfare Inspector to do with all this recreation, if it is provided? Well, some Institutes may be in a bad way for lack of funds, due to a declining membership and flagging enthusiasm on the part of the local Railwaymen. So, off he goes to investigate. Fraternising with the staff, from the senior men down to the junior, he gets all shades of opinion, and tries to ascertain the cause of decline. If the Institute is in need of funds to give it a new start in the way of recreative equipment worn out through good use, he will recommend a substantial grant from the Staff Benefit Fund. When the Institute gets this money, then it is on its feet again.

Quite a pleasant job he has, this Welfare Inspector. Admitted. It is pleasant to have a job whereby you can do all you can to make the lot of your fellow Railwayman happier, and relieve him of pressing worries and anxieties. But there is the unpleasant side too. Quite often some Railwayman feels he has a just cause for grievance against his immediate authorities—perhaps he feels he has been deprived of an increment due, or some promotion. Or if he has been involved in a case where some disciplinary action has been taken against him, and he has been punished, he may think he has been victimised. The Welfare man is now put on to the job of getting at the real facts of such grievances, and this requires a lot of detailed and routine work to get at the truth of the matter.

Other Railwaymen may envy the Welfare Inspector his job, but not every Railwayman is blessed with what is required of this Welfare man—natural characteristics of unending patience, charm, tact, and above all, good neighbourliness.



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National Hockey

By A Correspondent

1951 is an historic year for hockey in Madras. For the first time the National hockey championship is being held on the lovely Chepauk ground. Off the field and on it Madras gave a splendid start to the tournament by out-playing Orissa to the tune of 9 goals. It was a very good show. Madras forwards exhibited great combination. Sivaprakasam, Govindaswamy and Carr were the notable forwards, while Richtor and Scanlon formed the pillar of defence. The next few matches that followed were not at all good. The game did not reach the good standard in the first round. The most sensational match in the first round was the encounter between Pepsu and Hyderabad, Pepsu team gave a very fine exhibition of very first and vigorous hockey, but they did not possess the luck and Hyderabad got the better of it. Later Hyderabad lost to United Provinces team, and the winners gave a delightful display. Idris, inside right of U.P., and Tewari, their outside left, earned repeated applause for their fine display.

The largest gathering watched Mysore at play against Delhi. Considering the reputation of both the teams class hockey was expected. But the game was not up to the standard and it ended in a draw. In the replay Mysore defected Delhi by 3 goals to nil. Rajagopal and Kothandapani were the best in the forward line of Mysore while Sabjan and Archer proved a tower of strength in the defence line. Desamuthu did his part exceedingly well.

In the Quarter Final series Madras put up her best performance against the formidable Punjab XI. It was easily the best match up to that day in the tournament. As for the game Punjab did not impress as a formidable side they are reputed to be. Udam Singh and Balbir Singh showed glimpses of their skill in the attack. Sahib Singh in the centre half and Trilochan Singh at right back were conspicuous in defence. Richtor covered himself with glory in Madras ranks giving classic exhibition at right back. Madras lost the match.

Next Mysore met the Indian Railway team and a goalless draw resulted. In the replay, Railway team lost to Mysore by a very close margin. The Railway Team led by the Olympic captain Kishen Lal did not fare well. Cabral the Railway custodian did his part well by effecting good saves. In the forward line Kishen Lal was the only conspicuous player who moved with grace. Ramsbotham and Jones of Southern Railway played useful game in the forward line but there was no scope for them against such good defensive side as Mysore.

Services Team had an easy victory in the earlier rounds and they entered the semi-final. The semi-final match between Bombay and Services XI was very interesting and Services won the match. Rodrigues in the forward and Gentle in the back of Bombay were outstanding. The semi-final encounter between Bengal and Punjab was the most interesting. The match ended in a draw on two occasions and on the third day Punjab won the match. Bengal had a very good defence. The half line formed by Jaswant at centre, Claudius at right and Da Luz at left was very sound. Punjab forwards were again unimpressive.

The Championship was won by Punjab and luck favoured them to a great extent. Services put up a good fight but unfortunately they lost the match. It was rather unfortunate that the title should have been decided by a penalty goal. Ram Prakash the Punjab goal keeper was responsible for their victory. Punjab forwards were not in good form but luckily they managed to retain the trophy for the third time in succession.

The National Hockey championship Tournament came to an end in a most successful manner and Madras Hockey Association deserve to be congratulated on the success of the Tournament.

Too many take the ready course to deceive themselves: for they look with both eyes of the failings and defects of others, and scarcely give their good qualities half an eye, while, on the contrary, in themselves, they study to the full their own advantages, and their weaknesses and defects they skip over, as children do their hard words in their lesson, that are troublesome to read.—LEIGHTON

With righteousness in the heart there will be beauty in the character. With beauty in the character, there will be harmony in the home. With harmony in the home, there will be order in the nation. With order in the nation, there will be peace in the world.—CONFUCIUS.

Do You ?

Do you throw empty bottles or tins from a moving train ? A Gangman or other Railway employee working on the line may receive serious injuries if you do.

Do you light a methylated spirit stove in your compartment or throw a burning match on the floor ? Fires often result when you do.

Do you lean out of a window or rest with an arm or leg protruding out of the window ? Serious accidents have happened to passengers who do.

Do you attempt to board or alight from a moving train ? If you do, please *don't* ; for many fatal accidents have resulted to people who do.

Do you cross the Railway lines on the level or do you use the overbridge provided ? *It is safer to* climb the stairs.

HINTS TO GUARDS IN GENERAL

Guard against theft by always being alert on duty.

Outgoing Guards should see that they receive a copy of the invoice for each sealed loaded wagon on their train.

Observe the rules which prohibit rough shunting, especially wagons containing explosives, oil, live-stock and fragile goods.

Don't start your train without seeing that loads on open trucks are properly secured.

See that all wagons loaded with merchandise on your train are correctly sealed and rivetted and check your couplings.

Accidents can be minimised by being vigilant and careful in your work.

Never neglect to see that the last Vehicle on your train has a tail lamp, is clear of the fouling mark, and that signals in rear have been returned to the 'ON' position.

Don't forget to protect your train by using detonators, especially the adjacent line when accident occurs where double line working is in force.

Passengers should be treated with civility and tactfulness to gain their confidence.

Alarm chain when pulled should be investigated immediately.

See that the third class ladies' compartment is next to the upper class carriage.

Special attention should be paid to security bolts and catches in ladies' compartments.

Ensure that all passengers are entrained before giving the starting signal.

No parcels or luggage should be accepted unless clearly and legibly labelled, and accompanied with P. W. Bill or L. Ticket.

Guards should lock their Brake Van and Dog-Box doors to prevent theft.

Especially see the tape and seal of the cash bag is correct before dropping it into the cash safe.

Remember your duty when a passenger is suffering from an infectious or contagious disease.

Give the required attention to your equipment and see that it is properly kept.

Use your commonsense in an emergency.

Advise the yard staff by memo, on arrival at destination, of wagons containing perishables, live stock and dangerous goods to avoid rough shunting and detention in yards.

Remove causes giving rise to payment of claims by careful handling, correct loading and unloading and repacking.

Duty done well is always appreciated.

Service to the public first, last and at all times.

(Inserted in the interests of our Railwaymen)